Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Canadian Science Advisory Secretariat (CSAS)

Research Document 2017/013

Newfoundland and Labrador Region

Identification and Descriptions of Ecologically and Biologically Significant Areas in the Newfoundland and Labrador Shelves Bioregion

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July 2017

Canada

Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the Secretariat.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

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ISSN 1919-5044

Correct citation for this publication:

Wells, N.J., Stenson, G.B., Pepin, P., and Koen-Alonso, M. 2017. Identification and Descriptions of Ecologically and Biologically Significant Areas in the Newfoundland and Labrador Shelves Bioregion. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/013. v + 87 p.

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ABSTRACT

The *Oceans Act* (1997) commits Canada to maintaining biological diversity and productivity in the marine environment. A key component of this is to identify areas that are considered to be ecologically or biologically significant. Fisheries and Oceans Canada (DFO) has developed guidelines on the criteria that are to be used to identify Ecologically and Biologically Significant Areas (EBSAs) within Canada's waters. These criteria were applied to the Newfoundland and Labrador (NL) Shelves Bioregion, north of the Placentia Bay-Grand Banks (PBGB) Large Ocean Management Area (LOMA) to facilitate the identification of candidate EBSAs. An EBSA Steering Committee, comprised of experts in oceanography, ecosystem structure and function, taxa-specific life histories and Geographic Information Systems (GIS) guided this process by advising or aiding in the identification, collection, processing and analysis of data layers, as well as participating in the final selection of candidate EBSAs. A peer review meeting was held October 23-25, 2012 during which the candidate EBSAs were reviewed and the final EBSAs were agreed upon and delineated. A total of fifteen EBSAs were identified within the study area; three of these areas are considered to be primarily coastal areas; seven are in offshore areas; four EBSAs straddle coastal and offshore areas; and one is a transitory EBSA that follows the southern extent of pack ice.

Désignation et description des nouvelles zones d'importance écologique et biologique dans la biorégion des plateaux de Terre-Neuve-et-Labrador

RÉSUMÉ

La *Loi sur les océans* (1997) engage le Canada à sauvegarder la diversité biologique et la productivité du milieu marin. L'un des éléments clés de cet engagement est de désigner les zones qui sont considérées comme importantes sur le plan écologique et biologique. Pêches et Océans Canada (MPO) a élaboré des lignes directrices sur les critères qui doivent être utilisés pour désigner les zones d'importance écologique et biologique (ZIEB) dans les eaux du Canada. Ces critères ont été appliqués à la biorégion des plateaux de Terre-Neuve-et-Labrador, au nord de la zone étendue de gestion des océans (ZEGO) de la baie Placentia et des Grands Bancs, afin de faciliter la désignation de ZIEB admissibles. Un comité directeur des ZIEB, composé d'experts en océanographie, en structure et fonction des écosystèmes, en cycles biologiques propres à des taxons et en système d'information géographique (SIG), a dirigé ce processus en offrant des conseils ou en contribuant au recensement, à la collecte, au traitement et à l'analyse de couches de données, ainsi qu'en participant à la sélection finale des ZIEB admissibles. Une réunion d'examen par les pairs a été tenue du 23 au 25 octobre 2012, au cours de laquelle on a examiné les ZIEB admissibles ainsi que choisi et délimité les ZIEB finales. Un total de quinze ZIEB ont été désignées au sein de la zone d'étude; trois de ces zones sont considérées comme étant principalement des zones côtières; sept se situent dans des zones extracôtières; et une est une ZIEB temporaire qui suit l'extrémité sud de la banquise.

INTRODUCTION

Under Canada's *Oceans Act* (1997), "conservation, based on an ecosystem approach, is of fundamental importance to maintaining biological diversity and productivity in the marine environment". This Act provides the legislative framework for an integrated ecosystem-approach to management in Canadian oceans, particularly in areas considered ecologically or biologically significant.

Fisheries and Oceans Canada (DFO) Science has developed guidance on the identification of Ecologically or Biologically Significant Areas (EBSAs) (DFO 2004) and has endorsed the scientific criteria of the Convention on Biological Diversity (CBD) for identifying ecologically or biologically significant marine areas as defined in Annex I of Decision IX/20 of its 9th Conference of Parties. In 2011, a DFO National Advisory Process was held to examine the lessons learned in previous applications of the national guidelines to identify EBSAs within the Department's five national Large Ocean Management Areas (LOMAs). This additional guidance (DFO 2011a) was intended to address potential issues that may arise while moving forward with the identification of additional EBSAs outside the LOMAs.

In support of domestic integrated management efforts, EBSAs have already been identified in each of DFO's five LOMAs, including the Placentia Bay-Grand Banks (PBGB) LOMA (Templeman 2007), as well as in the Arctic region. Advice on the identification of additional EBSAs that are within the larger Newfoundland and Labrador (NL) Shelves Bioregion north of the PBGB LOMA will serve as a key component of the knowledge and advice for:

1. Developing Canada's network of MPAs to meet the domestic and international commitments noted above, and
2. Facilitating the implementation of DFO's Sustainable Fisheries Framework under the *Fisheries Act*.

In addition, this information will be of direct use to other federal Departments, as well as the Government of NL and other organizations, who are responsible for the management of activities in the NL Shelves Bioregion within their mandate (e.g. resource extraction, marine shipping, ocean dumping, spill response, cable laying, land use planning, etc.).

A DFO Regional Canadian Science Advisory Secretariat (CSAS) science advisory meeting was held on October 23-25, 2012 to review proposed EBSAs and to identify additional areas. This report provides a list of NL Shelves Bioregion EBSAs that were identified by applying the DFO EBSA criteria as defined by DFO (DFO 2004; DFO 2011a).

METHODS

STUDY AREA

The biogeographic unit within which EBSAs were identified is the NL Shelves Bioregion north of the Placentia Bay-Grand Banks LOMA (Figure 1). Off the northeastern coast of Newfoundland and the coast of Labrador, the study area extends eastward from the shoreline to Canada's Exclusive Economic Zone (EEZ) and from south to north between 49.8°N (Cape Freels) and 61.1°N (Cape Chidley). It is inclusive of Northwest Atlantic Fisheries Organization (NAFO) divisions 2GHJ3K.

GENERAL APPROACH

An EBSA Steering Committee, comprised of participants from DFO Science and Oceans Sectors, was formed in June 2011 to consider the available guidance and to lead the process of data identification, collection, processing and analysis which could be used to delineate candidate EBSAs within the NL Shelves Bioregion study area. The analysis was based on a synthesis of all available sources of information identified by the Steering Committee to be pertinent to the process. Relevant data were processed in a Geographic Information System (GIS) to develop spatially referenced data layers to allow for subsequent use in the identification and delineation of candidate EBSAs (Table 1).

In October 2012, a CSAS meeting was held to conduct a peer review of the proposed EBSAs and all relevant data. Meeting participants, consisting of science experts and other knowledgeable stakeholders, provided additional scientific knowledge pertinent to each EBSA before coming to consensus regarding the acceptance or rejection of each candidate EBSA. Additional EBSAs were also proposed and discussed based on expert scientific knowledge.

EBSA CRITERIA

There are five criteria for the identification of EBSAs:

1. Uniqueness or rarity;
2. Aggregation;
3. Fitness consequences;
4. Resilience;
5. Naturalness.

There are few datasets available in the NL Shelves Bioregion that enable the identification of areas that have specific fitness consequences for many species or species groups. While data were available for capelin spawning areas, seabird colonies, and beluga overwintering areas, most EBSAs were identified based on the uniqueness or aggregation criteria. Additional information on the application of the first three criteria is provided in Appendix B. Naturalness and resiliency were not considered during the identification or prioritization process, but their importance and significance was considered when discussing the other criteria.

INFORMATION SOURCES AND DATA TREATMENT

Data from various sources representing biological, physical and oceanographic features were collected from a variety of sources, with the majority coming from DFO and Environment Canada (Canadian Wildlife Service [CWS]). For some species there were multiple sources of information [e.g. for capelin there were acoustic data, research vessel (RV) survey data and spawning site data]. Because these different layers often applied to different EBSA criteria, they were reviewed and treated separately during the EBSA identification process.

For fish, it was determined that biomass data from fall RV surveys was the best indicator of trends over time. Some core species (i.e. species with high dominance in the fish community that have important roles in the food web and are, or have been, commercially relevant) and rare or endangered (Appendix C) species were treated separately, but most species were grouped by functional group. A functional group is a grouping of fish species based on general size and known food habits. Juvenile and spawning fish data were available for some species and based on the fact that these data were relevant to the EBSA criteria of fitness

consequences, each species for which there were juvenile or spawning data formed a single data layer.

Seabirds and waterfowl were plotted at the species, or sometimes guild level. Feeding and whelping areas for Harp and Hooded Seals were considered as separate layers. Cetaceans were considered by species when possible, but due to data limitations, were grouped as all Cetaceans when important areas for this taxonomic group were identified. Coral species were plotted by functional group based on habitat function. Some data sets were considered but not processed or included in the analysis for various reasons (see Ollerhead et al. 2017 for more information). For a list of all data layers, including layer groupings, treatments for final analysis (including temporal scale), lists of fish functional groups and bird and marine mammal species considered, see Table 1 and Ollerhead et al. 2017. For a list of common and scientific names referred to in this report, see Appendix D.

Rare or endangered species were recognized based on Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designations (see Appendix C) and were always treated separately (i.e. not combined with functional groups). A subset of these species is protected legally under the *Species at Risk Act* (SARA).

Traditional Ecological Knowledge (TEK) for the NL Shelves Bioregion was collected as part of a Community-Based Coastal Resource Inventory (CCRI) project, led by the Oceans Sector. DFO has been working with community groups since 1996 to document coastal fisheries resources. This information has been collected through direct contact with individuals and stakeholders in coastal communities around Newfoundland and Labrador. Knowledgeable people in the community were interviewed to identify areas where specific resources were known to occur. These areas were mapped on nautical charts and topographical maps. This information was entered into a GIS and used to produce the CCRI data layers (O'Brien et al. 1998). The CCRI data layers were used to validate and/or augment scientific data during the EBSA identification process; however these layers were not used exclusively during the identification process because they only provide information on species' presence (i.e. not absence) and they mainly consider areas of human use.

Data Limitations and Considerations

Data for many species, particularly fish, were limited in northern areas (e.g. NAFO Division 2G), as well as at depths greater than 1,500 m (see Brodie 2005). Data in coastal areas were also limited in scope and availability, with the possible exception of data that identified areas of aggregation and feeding for seabirds and waterfowl. Because of these limitations, the level of confidence in the delineation and boundaries for northern and coastal EBSAs is lower than for those in more data-rich areas. No EBSAs were identified in waters deeper than approximately 2,000 m due to lack of data.

The NL Shelves ecosystem has undergone major changes in the distribution and abundance of most species as a result of environmental changes and exploitation (e.g. Koen-Alonso et al. 2010 and references within; Halliday and Pinhorn 2009). Most drastic changes took place during the late 1980s and early 1990s, including the declines and collapse of many important groundfish stocks. In 1995, the sampling gear for DFO RV surveys in NL was changed from an Engel to a Campelen trawl. The lack of conversion factors for all species found in the surveys prevents the unifying of all data in a single series; therefore, the fall RV survey series associated with each sampling gear (Engel period 1976-94; Campelen period 1995-2010) were considered separately. For the production of the data layers considered in this analysis, each one of these gear-specific series was averaged over their time period (Ollerhead et al. 2017); these layers

can be coarsely interpreted as reflecting pre and post collapse conditions of the NL ecosystem, although other factors also contribute to their differences (e.g. gear catchability).

Although the changes in this ecosystem have been dramatic, there is nothing to indicate that this system cannot rebound to a pre-collapse state. In fact, some trends in recent years appear to suggest that the NL ecosystem may be moving towards a state with a higher groundfish, and lower shellfish, presence than what was observed during the late 1990s and early 2000s (Koen-Alonso et al. 2010). While the NL ecosystem is still far from the pre-collapse state, these signals suggest that a rebound towards a pre-collapse type of ecosystem structure is potentially possible. On this premise, it was assumed that those habitats that can be identified as candidate EBSAs based on pre-collapse data still have the capability to be significant as they were in the pre-collapse period. Therefore, pre- and post-collapse data series (e.g. Engel and Campelen RV survey data) were considered with equal weight in the process of identifying EBSAs. This applied to all DFO RV survey data (i.e. core fish species, fish functional groups, rare or endangered fish species, juvenile and spawning fish). Similarly, traditional whaling records were examined to provide additional data on the historical ranges of large cetaceans.

DATA PROCESSING AND ANALYSIS

All data used in the identification and delineation of candidate EBSAs in the NL Shelves Bioregion study area included metadata such as type, origin, scale, spatial and temporal range, as well as the methodologies used to collect the data (see Ollerhead et al. 2017 for details). All data were formatted for use in a GIS, ArcGIS v10.0, to store, manage, analyze, and display the spatially-referenced data. The data were processed to create over 200 spatially-referenced layers (Table 1) that were subsequently used to highlight the most ecologically and biologically important areas for each layer.

The identification of candidate EBSAs required the examination and overlay of data sources within a GIS. Therefore, the assessment process had to consider, and make compatible, data and/or information gathered at different spatial scales of resolution and details, particularly in areas near the coast, in order to adequately define areas of significance. In this context, the "nesting" of smaller areas within larger biogeographic areas allowed experts to assess the need for scaling up or down, depending upon the biological criteria being considered (see EBSA criteria). The majority of offshore data layers were resampled on a 20 km x 20 km grid, the smallest common scale for most datasets (i.e. DFO RV survey data), and permitted comparison of different data types at the same spatial scale.

Most offshore datasets were subjected to a density analysis to identify the highest concentration areas. For those offshore data layers that were sampled on the 20 km x 20 km grid, and for which quantitative information was available, the grid cells corresponding to the uppermost class (i.e. quantile) of the distribution were extracted and used in a subsequent overlay analysis to locate regions where multiple high concentration areas occurred. Individual biological data layers were reviewed by species group or data type by the EBSA Steering Committee. Species or subject matter experts were also invited to review the data and aid in the identification of areas that were considered significant based on the EBSA criteria, as well as to identify data gaps or outliers. Metadata were reviewed to ensure the species-specific information consisted of the best available data.

For the offshore only, layers with common taxa or characteristics were logically grouped into Conceptual Layers (Table 1) and then summed using Cell Statistics (see Ollerhead et al. 2017 for more information). All Conceptual Layers were then summed using Cell Statistics (i.e. all layers combined) to form the Composite Layer (Figure 2). This procedure was not done at the exclusion of a detailed review of the areas of importance for each taxa, but instead

enabled us to establish areas for which the delineation of an EBSA could serve multiple conservation objectives. The resulting important areas identified in the GIS analysis were then used to identify and delineate candidate EBSAs. For additional details, including exceptions see Ollerhead et al. 2017

At the peer review meeting it was noted that the offshore juvenile and spawning fish dataset (from DFO RV survey data) was not reliable given the sparseness of these data. It was determined that, while the areas that were identified were areas where juvenile or spawning fish had been present, these areas were not necessarily representative of nursery areas or spawning grounds. It was therefore decided that the delineation of EBSAs would not rely on these data as a key driver, rather they would be deemed consequential to an area once an EBSA had been delineated (i.e. "other biological features" present in an EBSA, Table 1).

Principal Components Analysis (PCA), used to transform data and eliminate redundancy in multivariate datasets, and *K*-means clustering were applied to summarize 38 layers of oceanographic (e.g. ice, temperature, salinity, currents, chlorophyll-a and productivity) and bathymetric data into a single layer for each season. For additional information on this analysis see Ollerhead et al. 2017.

DFO RV Survey data were used to perform diversity, richness and evenness analyses on all species within the dataset. These layers were used for reference purposes to ensure that the selection of candidate EBSAs effectively captured important areas highlighted by these indices. However, given that they represented diversity, richness and evenness for fish species only, and that RV survey data were represented in other data layers (i.e. core species, fish functional groups, rare or endangered species) they were not used during the EBSA identification process.

EBSA IDENTIFICATION

The EBSA Steering Committee used an iterative process to identify candidate EBSAs and refine boundaries:

- Step 1 – identify important areas (i.e. for several species or species groups) using the Composite Layer.
- Step 2 – identify important areas by reviewing Cell Statistics Layers for each Conceptual Layer (i.e. logical grouping based on common characteristics) or refine boundaries of EBSAs drawn during Step 1.
- Step 3 – review all individual data layers (Table 1) within each Conceptual Layer to identify important areas or refine boundaries of EBSAs identified during Steps 1 and 2.

This iterative process allowed the committee to identify important areas at different resolutions. It ensured that all data layers were examined in detail and that important areas for a given species or species group were not overlooked at coarser resolutions.

Data in coastal areas were treated separately and not included in the Composite Layer due to differences in scale. The identification of candidate EBSAs in coastal areas involved reviewing all coastal layers simultaneously to determine if certain areas visually emerged as 'hotspots' (i.e. areas occupied by multiple species or species groups). Scientific data layers were reviewed initially and CCRI data were then used to validate areas of importance.

Candidate EBSA boundaries were drawn as polygons using the free-hand tool in ArcGIS and were meant to identify important features in the area. The EBSA polygons were not resampled to the 20 km x20 km grid as it was determined that the boundaries were meant to encircle an important area, rather than indicate a transition from an important area to a non-important area. Also, it was suggested that if management actions are ever taken in a particular EBSA,

refinement of the boundary will occur at that time, and will be dependent on the conservation objectives that are established.

Once EBSA boundaries were delineated, the individual data layers that were found within each EBSA were identified (see Appendix E).

During the October 2012 CSAS meeting, the methods used to delineate candidate EBSAs were presented and each candidate EBSA was reviewed in detail. Each EBSA was discussed in detail and a decision was made whether to accept the EBSA as proposed, modify the EBSA boundaries based on existing data or scientific knowledge, or reject the EBSA. Additional EBSAs were also proposed with some being accepted and others being rejected. The key characteristics used to identify each EBSA are highlighted in the descriptions below (also see Table 2 and Appendix E).

Although a relative scoring scheme was requested for each EBSA it was agreed during the review that prioritization of the EBSAs would be dependent upon conservation objectives for management within the bioregion. Therefore, prioritization was determined to be of no further benefit at this time.

RESULTS

PCA AND CLUSTERING ANALYSIS

The derived data layers for each season identified statistically-similar oceanographic regions and, while not applicable for inclusion in the final cell statistics analysis, provided valuable supporting information during the EBSA delineation exercise. This information resulted in three regions being identified for each season – inshore, shelf, and offshore (Figure 3). However, while these terms denote their general location, the areas that were grouped because of similar characteristics varied somewhat geographically, particularly among seasons.

The inshore cluster consists of the shallowest sectors, with seasonal pack ice as a prominent feature. This area has variable bathymetry and the freshest waters (Figure 3). In winter this cluster has warmer bottom temperatures, but colder surface waters than the other areas. During spring and summer, primary productivity is highest in this region, with generally high surface concentrations of phytoplankton.

The shelf region includes areas with the most variable bathymetry, where some of the strongest surface and bottom currents are found (with the exception of the spring surface currents), as well as the highest bottom temperatures. Primary production is generally lowest of the three clusters, although the difference is minimal.

The offshore cluster consists of the deepest sectors (roughly 1,000m to 3,800 m depths), with the lowest amount of pack ice and some of the weakest surface currents. Surface waters are warmer and more saline than in the other clusters and bottom temperatures are generally colder. In the autumn, primary productivity is higher in this group of grid cells than in other regions.

FINAL EBSAS

Seventeen candidate EBSAs were identified in the study area by the Steering Committee and proposed for peer review (Figure 4). Through the peer review, three of those areas were unsupported; two areas were merged to become one; and two new areas were proposed and accepted. 15 EBSAs total were ultimately identified and delineated in the study area (see Figure 5 and Tables 2-4): three in coastal areas (Nain Area, Lake Melville and Gilbert Bay),

seven in offshore areas (Outer Shelf Saglek Bank, Outer Shelf Nain Bank, Hopedale Saddle, Labrador Slope, Labrador Marginal Trough, Notre Dame Channel and Orphan Spur); four spanning coastal and offshore areas (Northern Labrador, Hamilton Inlet, Grey Islands and Fogo Shelf). These EBSAs represent a total area of 194,821 km^2, which is approximately 31% of the entire study area (Tables 2-5). An additional EBSA was identified based on the southern extent of pack ice, but this area is transitory in nature and therefore cannot be delineated geographically.

The following descriptions indicate the dominant significant features leading to the identification of the 15 EBSAs; as well as other important attributes that were noted to occur in the area. Physical features, size and heterogeneity of each EBSA are provided in Tables 5-7. For maps indicating seabed features that are used in the descriptions below, see Figure 6. These features were delineated by Gordon Fader of Atlantic Marine Geological Consulting Ltd. by applying the same methodology used to map seabed features of the Scotian Shelf and Bay of Fundy (WWF-Canada 2009).

Coastal EBSAs

Three EBSAs were identified in coastal areas (Table 2, Figure 5). The primary data layers that were used to delineate these areas included those for Salmonids, Capelin spawning areas, Seabirds and Waterfowl. CCRI data were also reviewed to determine what species were present in the areas (Appendix E), although these data were not used to delineate the EBSAs.

Nain Area

The Nain Area EBSA (Figure 7) includes five bays (Webb Bay, Tikkoatokak Bay, Nain Bay, Anaktalik Bay and Voisey's Bay) that converge in an area along the Labrador coastline. This area is has a high level of nearshore marine productivity in part due to nutrient loading from local rivers (Power et al. 2000), especially the Fraser River which is 116 km long, 30 m wide at the mouth and drains an area of 1,606 km^2 (Dempson and Green 1985). This EBSA is adjacent to the north end of the Hopedale Saddle EBSA (see below).

The dominant data layers used to identify this EBSA include those for several species of waterfowl and seabirds, as well as Capelin and Arctic Charr. A number of seabird and Common Eider colonies occur in the area, including an important Thick-billed Murre colony. Other species of birds known to aggregate here include Black Guillemots, sea ducks and Glaucous Gulls. A Capelin spawning beach was identified here based on both scientific data and TEK. Nain Bay and surrounding areas are also noted to be highly productive for Arctic Charr, contributing significantly to juvenile rearing, as well as juvenile and adult feeding (Dr. B. Dempson, DFO, pers. comm., Dempson and Kristofferson 1987).

Experts familiar with the area identified several aspects of the land fast ice habitat in the Nain area as being relatively unique and important to overall productivity of the EBSA. The many coastal islands anchor and protect the land fast ice from excessive compression by pack ice while the pack ice itself protects the coast from winter and early spring storm surges. This land fast ice habitat is an important overwintering and breeding area for ringed seals and is particularly important for polar bears, wolves, foxes and ravens that hunt or scavenge on seals that use the habitat. The land fast ice also provides a migration or seasonal travel corridor for several species including terrestrial predators and caribou. Geomorphological features, known as boulder flats and boulder barricades, are also common in this area and are a result of ice transporting boulders from the shore into the intertidal zone. Voisey's Bay also has the largest sand delta in the area, which is an important feature for seabirds. A population of spawning salmon occurs here, as well as some of the largest Glaucous Gull congregations in the study area. An Important Bird Area (IBA) is found within the boundaries of this EBSA. The Nain

Coastline IBA is known for congregations of Harlequin Duck, Peregrine Falcon and Surf Scoter (see Appendix F). The "Offshore Islands Southeast of Nain" IBA also overlaps the southeast boundary of this EBSA.

CCRI data identified a number of areas where aggregations of groundfish, pelagic fish, shellfish, marine mammals and aquatic plants occur within the boundaries of this EBSA.

Lake Melville

Lake Melville (Figure 8) is a saltwater tidal extension of Hamilton Inlet and one of the largest fjords in eastern Canada (3,069 km^2). It extends inland approximately 130 km from Hamilton Inlet and is characterized by two basins, Goose Bay and Lake Melville proper. Goose Bay has a maximum depth of 55 m and Lake Melville has a maximum depth of about 220 m. The Churchill River drains much of the Labrador plateau and provides 75% of the freshwater input to Lake Melville through Goose Bay. The marine influence is also strong in this system and brackish waters occur all the way up into the braided Churchill River channel beyond the inflow to the estuary. The EBSA encompasses the entire Lake Melville area and also includes the narrows leading into Double Mer as well as the narrows surrounding Henrietta Island and The Backway. The outer boundary occurs just outside Rigolet at the narrows leading into Hamilton Inlet, and meets the inner boundary for the Hamilton Inlet EBSA. Double Mer was not included as this is a freshwater lake.

All of the significant features of this area were highlighted by experts during the peer review meeting. However, a post-meeting review of data layers revealed that the area is also important to sea ducks (with Surf Scoters being the main species) and Geese. The brackish waters of Lake Melville represent a unique habitat within the study area. Productivity and species diversity are notably high in Lake Melville; and this area is also the northern most distribution of many of the species occurring there.

The dynamic nature of Lake Melville, along with being located at the juxtaposition of several biogeographic boundaries, contributes to the diversity of fish species occurring there. This includes various freshwater species found in the upper, brackish areas of the fiord (e.g., Lake Whitefish, White and Longnose Suckers), diadromous species such as Brook Trout and Rainbow Smelt that feed extensively within the fiord; as well as a variety of marine species including Thorny Skate, Atlantic Tomcod, Laval's Eelpout, Arctic Eelpout, Sculpin, Atlantic Sturgeon, among others. The area is also an important area for sea run trout and Atlantic Salmon, as several spawning rivers and juvenile rearing areas occur there. The Backway, at the eastern end of Lake Melville, is unique for the Surf Scoter as the highest counts of moulting individuals of this species in eastern Canada have occurred there; for this reason, the Backway is recognized as an IBA (see Appendix F). The eastern portion of the Lake is an important overwintering and breeding area for ringed seals resulting in particularly high winter and early spring densities in the area. There is also a resident population of harbour seals in the Lake.

Lake Melville also contributes significantly to the productivity of the adjacent Hamilton Inlet as well as the Labrador Shelf south of its outflow by contributing inorganic nutrients to the spring bloom communities of the shelf. It is also worth noting that ashkui form in the Narrows and in other isolated areas within this EBSA.

CCRI data identified a number of areas where aggregations of groundfish, pelagic fish, shellfish, marine mammals and aquatic plants occur within the boundaries of this EBSA.

Gilbert Bay

Gilbert Bay, located on the southeast coast of Labrador, is a shallow-water, low-gradient, subarctic fjord composed of a series of basins separated by sills that become shallower towards

the head. The bay is 28 km long and is less than 4 km at its widest point, covering approximately 60 km². The Gilbert Bay EBSA (Figure 9) extends from the head of Gilbert Bay out to the headlands of Salmon Point to the north. The EBSA also includes Alexis Bay and surrounding coastal areas to Spear Point in the south, as all of these areas are considered to be important habitat for Gilbert Bay cod. A Marine Protected Area (MPA) has been established in Gilbert Bay since 2005.

Some unique geomorphology and hydrography features influence the ecology of the species in the area, including a genetically distinct resident population of Atlantic Cod. Other species that are important in the Gilbert Bay area include Arctic Charr and Atlantic Salmon. Capelin are also extremely important to the local ecology and are known to spawn in the area.

A post-meeting review of data found within the boundaries of this EBSA revealed that Soft Corals are found along the outer edge of the EBSA and seabirds have been known to congregate in the area. CCRI data identified a number of areas where aggregations of groundfish and shellfish occur within the boundaries of this EBSA.

Coastal and Offshore EBSAs

Four EBSAs were identified based on a combination of coastal and offshore data (Table 3, Figure 5). The key data layers used to identify the following areas included those for Salmonids, Capelin spawning areas, corals and sponges, rare or endangered fish species, core fish species, fish functional groups, marine mammals, seabirds and waterfowl.

Northern Labrador

The Northern Labrador EBSA (Figure 10) extends from Cape Chidley to just south of Saglek Bay along the coast, and offshore to include part of Saglek Bank.

This EBSA was mainly identified as an important migratory area for the endangered Eastern Hudson Bay Beluga, as well as important coastal areas for *SARA* listed waterfowl. Harlequin Duck and Barrow's Goldeneye (species of 'Special Concern' under *SARA*) occur in relatively high densities in the fjords in this area. Also, this was the only location that Barrow's Goldeneye was found in the highest concentrations (upper tenth percentile) within the study area.

Other species occur in this area in high concentrations, but not are necessarily key to identification of the EBSA. The Common Eider and other sea ducks concentrate here during winter months, while important Black Guillemot and Glaucous Gull colonies are also located in the area. High densities of other seabirds (Black-legged Kittiwake, murres, Northern Fulmar, skuas and jaegers, Herring Gull) have been found during pelagic surveys in the area. Two IBAs, Seven Islands Bay and Galvano Island, are found within this EBSA because of some of the species listed above (see Appendix F). In the fish community, medium benthivores and plankpiscivores were common during the Engel period, however DFO RV survey data are limited in this northern region.

Some other important features of this area include increasingly important summer and early fall polar bear habitat that provides both nearshore feeding opportunities as well as a migration corridor. The coastal area was also noted for significant summer feeding and haul out activity of ringed seals that are the main prey of polar bears frequenting the area at that time of year. The area also features aggregations of birds (e.g. Glaucous Gull, Common Eider) and is an important rearing and feeding area for Arctic Charr.

Hamilton Inlet

The Hamilton Inlet EBSA (Figure 11) includes the coastal and inner shelf area (approximately out to the 200 m isobath) outside of Hamilton Inlet, Sandwich Bay and south to Island of Ponds.

This EBSA is adjacent to the Lake Melville EBSA to the west and the Labrador Marginal Trough EBSA to the east but was kept separate because of the differences in habitat type and key features identified.

The dominant data layers identifying this EBSA include those for Capelin, Atlantic Salmon and seabirds. Several Capelin spawning beaches occur at the southern end of the EBSA, while Paradise River, Eagle River, White Bear and North Rivers (Sandwich Bay area) are highly productive for Atlantic Salmon (Dr. B. Dempson, DFO, pers. comm.). The coastal area outside of Sandwich Bay was identified as having the highest density of Atlantic Salmon in the NL shelves bioregion during summer drift net surveys (1965-2001). While several bird species are found here in high concentrations, it should be noted that two of the three highest density Atlantic puffin colonies, and all four of the highest density Razorbill colonies that occur in the study area are found within this EBSA.

This area includes other features that enhance overall productivity. The EBSA occurs at the outflow of Lake Melville, which drains most of the Labrador plateau and provides nutrients that are critical to initiate primary productivity blooms along the Labrador coast. Ashkui, large and productive areas of early or permanent open water surrounded by sea ice (Sable et al. 2006), also form in this EBSA annually.

Traditionally, the main harp seal whelping concentration usually forms on the pack ice in this EBSA. The western portion of Inlet is an important fall and early winter feeding area for ringed seals. The area also is important for several waterfowl species (dabbling ducks, geese and sea ducks, including Common Eider). Colonies of Great Black-backed Gull, Herring Gull and Northern Fulmar also occur in the area. High concentrations of many seabird species (Atlantic Puffin, murres, Northern Gannet, Razorbill, Dovekie, skuas and jaegers, and Sooty Shearwater) and Harlequin Duck (species of 'Special Concern' under SARA) occur within this EBSA. The high diversity of birds in the area has resulted in eight IBAs being identified within the boundaries of this EBSA: Goose Brook, South Groswater Bay Coastline, Northeast Groswater Bay, Tumbledown Dick Islands and Stag Islands, Cape Porcupine, Gannet Islands, Table Bay, and Bird Island (see Appendix F). CCRI data also identified many species in several areas of this EBSA (see Appendix E).

Grey Islands

The Grey Islands EBSA (Figure 12), located east of the Northern Peninsula on the island of Newfoundland, includes the coastal areas surrounding the Grey Islands and extends inshore to include part of Hare Bay and southeast along the inner shelf towards Fogo Island. The southern boundary is adjacent to the Fogo Shelf EBSA.

The dominant data identifying this EBSA include those for waterfowl and seabirds in coastal areas; as well as those for seabirds on the shelf. Along the coast, sea ducks, specifically Common Eider and the Harlequin Duck (species of 'Special Concern' under SARA) occur in high concentrations. The Great Black-backed Gull, Herring Gull and terns also have important breeding colonies in this area. A high diversity of seabird species (e.g. Common Murre, Black-legged Kittiwake, Dovekies, Great Black-backed Gull, Greater Shearwater, Herring Gull, murres, Northern Fulmar, Northern Gannet, phalaropes, Atlantic Puffin, skuas and jaegers, Sooty Shearwater, storm petrels and terns) also aggregate along the inner shelf area within this EBSA and may be considered an indication of high, year-round, productivity in that area. The Grey Islands area also corresponds with three previously identified IBAs all near the northeastern edge of this EBSA: Fischot Islands, Northern Groais Island and Bell Island South Coast (see Appendix F).

In the inner shelf area, Soft Corals and Small Gorgonians are found in high concentrations, while Capelin were found in aggregations here during the Campelen period. CCRI data also identified small distinct areas within this EBSA where groundfish, pelagic fish and shellfish are known to occur.

Fogo Shelf

The Fogo Shelf EBSA (Figure 12) extends from the headlands at the western entrance of the Bay of Exploits and approximately follows the 200 m isobath eastward to the study area boundary near Cape Freels. It includes the larger islands such as Twillingate Island, New World Island and Fogo Island, as well as many smaller islands in the Bay of Exploits and Gander Bay areas. The ecological importance of this area, especially related to productivity, likely extends south of the study area boundary into NAFO Division 3L.This is evident based on the previous identification of an IBA that extends along the coast from just north of Cape Freels south to the headlands outside of Indian Bay.

The dominant data layers used to identify this EBSA include those for Capelin, Atlantic Salmon, several waterfowl and seabird species, and cetaceans.

This area is noted not only for the diversity of species that occur here, but also because of the high number of species that use this area for an important part of their life history. The coastal area of this EBSA is noted for an abundance of beach and sub-tidal capelin spawning areas (Penton and Davoren 2012), with the greatest concentrations on North Twillingate Island and along the coast west of Cape Freels. Penton and Davoren (2012) found that the continued presence of suitable spawning sediment in permanent bathymetric depressions was a key determinant of site use persistence, which led to the formation of a biological hotspot as top predators aggregate over deep-water spawning sites of forage fish. The Bay of Exploits area is very important for Atlantic Salmon, with the highest total returns of all monitored rivers in the study area concentrated in this area. The Gander Bay area, fed by the Gander River, is the second most productive salmon river on the island within the study area; hundreds of thousands of salmon smolts migrate into these nearshore areas and feed before moving out into the north Atlantic. Much of the mortality impacting salmon is believed to occur during the time when smolts first enter the marine environment and so coastal areas are very important to the subsequent survival of salmon smolts. They are also important migration and feeding areas for returning adult salmon including kelt (previous spawners).

The shelf area of this EBSA includes Funk Island, an ecological reserve home to the largest Common Murre colony in the western North Atlantic and the only Northern Gannet breeding colony in the bioregion study area [see Appendix F for a listing and map of all IBAs found within the study area]. Other bird species that aggregate in high concentrations throughout this EBSA include sea ducks, specifically Common Eider, Atlantic Puffin, Great Black-backed Gull, Greater Shearwater, Herring Gull, Northern Fulmar, Thick-billed Murre and terns. Three IBAs are found within the boundaries of this EBSA: Funk Island, Wadham Islands and adjacent Marine Area and the northern portion of Cape Freels Coastline and Cabot Island. Important cetacean feeding areas have also been identified in this area.

Small benthivores occurred in high densities on the shelf area of this EBSA during the Campelen period. Male Hooded Seals are known to use the deep water channels in this area during the winter. Finally, CCRI data identified several areas where groundfish, pelagic fish, shellfish, aquatic plants and marine mammals are present within this EBSA.

Offshore EBSAs

Eight EBSAs were identified in the offshore portion of the study area (Table 4, Figure 5), including one EBSA based on the southern extent of pack ice. Data layers used to identify offshore areas included those for corals and sponges, rare or endangered fish species, core fish species, fish functional groups, marine mammals and seabirds.

In the offshore, the entire Labrador Shelf edge and slope was highlighted to be ecologically important through a combination of data and expert knowledge based on its high productivity and diversity relative to the shelf itself. However, the entire area was not delineated as an EBSA to reduce the risk of minimizing the enhanced significance of specific areas within. The most significant areas of aggregation were often associated with areas of unique bathymetry, such as banks, troughs and spurs.

Outer Shelf Saglek Bank

The Outer Shelf Saglek Bank EBSA (Figure 10) includes the outside edge of Saglek Bank as well as northern parts of the outer shelf and Labrador Slope that extend beyond Saglek Bank. The northern boundary for this EBSA is the study area boundary itself. While the boundaries are based on species aggregations, this EBSA generally extends from the 200-2,000 m isobaths.

The dominant data layers identifying this EBSA include those for corals, sponges, marine mammals, and seabirds. Sea pen concentrations exist in the northwest portion of this EBSA, while significant concentrations of Large Gorgonian corals and sponges are found along the slope. Various species of marine mammals frequently aggregate throughout this EBSA – Harp and Hooded Seals feed here extensively during the summer; and several species of whales, including Northern bottlenose and sperm whales, migrate through, and feed, in the area. The Ivory Gull, listed as endangered under SARA, is also found in high concentrations throughout much of this EBSA.

The Outer Shelf Saglek Bank area was also noted as being important for several other species of seabirds – high densities of skuas and jaegers, phalaropes, Northern Fulmar, murres, Greater Shearwater, Dovekie, and Black-legged Kittiwake can occur here.

Roundnose Grenadier, which was designated as endangered by COSEWIC, was found in significant concentrations near the north end of the Labrador Slope during the Engel period.

Notably, this EBSA overlaps with the southward extension of another EBSA that was identified north of the study area boundary during a similar EBSA exercise in the Central and Arctic Region. This area was identified for having high benthic diversity, high biological productivity and several rare or endangered species (DFO 2011b).

Outer Shelf Nain Bank

The Outer Shelf Nain Bank EBSA (Figure 7) includes the outer shelf and Labrador Slope area (from approximately the 200 m to the 2,000 m bathymetric contour) adjacent to Nain Bank.

The dominant data layers identifying this EBSA include those for various corals, fish, marine mammals and seabirds. In general, the area is high in diversity. Black Corals, Sea Pens and Stony Cup Corals occur in high concentrations near the south end of this EBSA. High concentrations of various fish species, including small and medium benthivores, as well as planktivores, occur throughout. Hooded Seals frequent the area for feeding – juveniles from August to February; and adult females year round. Several seabird species also aggregate here, including Black-legged Kittiwake, Dovekie, phalaropes, skuas and jaegers, terns and Ivory Gull. Thick-billed Murre also use the area during the spring.

This area is also part of a larger area along the Labrador Shelf that has been used as a summer feeding area for harp seals.

Hopedale Saddle

The Hopedale Saddle EBSA (Figure 7) includes the inner shelf and Labrador Marginal Trough adjacent to the Nain Area EBSA, and extends southward to include the northern part of Makkovik Bank. The eastern portion of the EBSA includes the high point of Nain Bank at the north end and extends offshore to include the Hopedale Saddle.

The key feature used to identify this EBSA is that it is a unique overwintering area for the endangered population of Eastern Hudson Bay Beluga. Satellite tagging data have indicated beluga diving activity in this area which suggests repeated movement between partially ice-covered sea surface habitats and warmer, deep-sea areas. Such activity may be associated with foraging.

Several other coral, fish, marine mammal and seabird species, including many that are rare or endangered (e.g. Skates, Atlantic and Spotted Wolffish, Roundnose Grenadier, Ivory Gull), are found in high densities throughout parts of this EBSA.

Also abundant in the area are Sea Pens, Soft Corals and Small Gorgonians, with Sea Pens occurring in higher concentrations near the 400 m isobath and other coral species occurring in deeper waters at the offshore edge of the EBSA. Shrimp, Greenland Halibut, Redfish, plankpiscivores, planktivores, piscivores, and small and medium benthivores were also found here in high concentrations during the Campelen period. The large area identified as a summer feeding area for Harp Seals intersects this EBSA and female and juvenile Hooded Seals spend time in the outer portion of this EBSA from August to February. Several species of seabirds were found here in high densities during pelagic surveys (Black-legged Kittiwake, Dovekie, Greater Shearwater, murres, Northern Fulmar, phalaropes, Atlantic Puffin, Razorbill, skuas and jaegers, Sooty Shearwater and terns) and the outer boundary was extended slightly northward to include an area where the endangered Ivory Gull was found in high densities (in addition to Black-legged Kittiwake, Dovekie and phalaropes). A Glaucous Gull colony and a Thick-billed Murre colony (the only highest concentration colony in the study area) also exist on the inner islands within the northern portion of this EBSA. These congregations, along with those of other bird species, contributed to the identification of the Offshore Islands Southeast of Nain IBA in this area (see Appendix F).

Labrador Slope

The Labrador Slope EBSA (Figure 13) generally includes the slope from the 400 m to 2,000 m isobath and extends from the outer edge of Makkovik Bank, southward along the slope to the outer edge of Belle Isle Bank.

The dominant features used to identify this EBSA include corals, sponges, rare or endangered fish species, core species, and fish functional groups. In general, the area is high in diversity. High densities of corals and sponges are concentrated in various areas throughout the EBSA - Soft Corals in the north and south, Black Corals in the north, and sponges centrally near Hamilton Spur. Several rare or endangered fish species, including Atlantic, Spotted and Northern Wolffish, Roundnose Grenadier and skates have significant concentrations within the area; as do species such as Northern Shrimp, Greenland Halibut, Redfish, Atlantic Cod and American Plaice. All fish functional groups also occur in high densities along the Labrador Slope.

Species of corals (including Small and Large Gorgonians) other than those identified in the initial data layers have been noted to occur in high concentrations along the entire slope edge.

Also, Harp Seals and juvenile and female Hooded Seals, as well as a variety of cetaceans and seabirds (Black-legged Kittiwake, Dovekie, Great Black-backed Gull, Greater Shearwater, Ivory Gull, Sooty Shearwater, murres, Northern Fulmar, Terns, skuas and jaegers and phalaropes), frequent the Labrador Slope area in high relative numbers for feeding.

The Labrador Slope EBSA, along with the Orphan Spur EBSA (see below), is characterized by high bathymetric relief with depth ranges of 200 m to 2000 m. These areas have shown consistent importance in terms of biodiversity over time despite large changes observed in this ecosystem (see DFO 2006). Among the changes observed during the late 1980s and early 1990s several species changed or expanded their distribution into deeper waters (Halliday and Pinhorn 2009). The Labrador Slope area was one of two distinct areas identified in the Northwest Atlantic as coral species richness hotspots by Wareham and Edinger (2007); 14 species of corals were found concentrated on the shelf edge and slope with some neptheid Soft Corals on the bank tops.

Labrador Marginal Trough

The Labrador Marginal Trough (Figure 13) EBSA extends from the Cartwright Saddle south through the Labrador Marginal Trough and into the Hawke Saddle, just inside Hamilton Bank.

The dominant data layers used to identify this EBSA include those for several core fish species and various marine mammals. Shrimp, Snow Crab, Greenland Halibut, American Plaice, Witch Flounder and Capelin occur in high densities at the north and south ends of this EBSA. The middle portion of this area (trough area) is a potential corridor for several species of fish and marine mammals and includes part of the area of highest probability of use for harp seal whelping and summer feeding. Cetaceans aggregate in this area for feeding during the fall but also frequent Hamilton Bank and out to the Labrador Slope at the same time.

Aggregations of plankpiscivores (in the north and south ends), small benthivores (in the south end), and medium benthivores (along the edges of Hamilton Bank extending into the area) also occur or have been known to occur in this EBSA. Hooded Seals (males, females and juveniles) are known to frequent parts of this EBSA from August to February. Finally, this area has been shown to be important for several species of seabirds, including murres, Black-legged Kittiwake, Great Black-backed Gull, Herring Gull, Northern Fulmar, Atlantic Puffin, skuas and jaegers, Sooty Shearwater, and the endangered Ivory Gull.

Notre Dame Channel

The Notre Dame Channel EBSA (Figure 12) is part of a larger channel that extends offshore from Notre Dame Bay out towards the Labrador Slope, and branches southward along the inner edge of Funk Island Bank. This EBSA includes only the southeast branch of the Channel between the Fogo Shelf area and Funk Island Bank.

The high diversity of this EBSA was highlighted in the composite layer (i.e. it represented significant occurrence for multiple species). Dominant data layers in this EBSA include those for cetaceans, skates, and several core fish species. The area is significant for cetacean feeding and migration. Skates (including Smooth Skate and the Thorny Skate, designated as endangered and special concern by COSEWIC, respectively) have consistently occurred in high densities throughout the area over time (i.e. during both the Engel and Campelen periods). Significant aggregations of Capelin, American Plaice, Greenland Halibut, Snow Crab and Shrimp currently exist in this EBSA, while Witch Flounder, Redfish, and Greenland Halibut were noted to occur here in high concentrations during the (earlier) Engel period.

This EBSA is also frequented by several species of seabirds, including murres, Black-legged Kittiwake, Great Black-backed Gulls, Northern Fulmar, Northern Gannet, phalaropes, skuas and

jaegers, Sooty Shearwater and storm petrels. Harp seals are known to feed in this and surrounding areas during winter months.

Orphan Spur

The Orphan Spur EBSA (Figure 14) encompasses a large area that extends along the Labrador Slope and outer shelf in NAFO Division 3K, and includes the Orphan Spur and part of the Trinity Trough Mouth Fan. The northern portion of the EBSA extends from 400 m to 2,000 m depth, although south of the Orphan Spur the maximum depth is approximately 1,000 m.

Similar to the Labrador Slope EBSA, this area is high in diversity as a number of species are found here in high concentrations. The dominant data layers used to identify this EBSA were those for corals, fish, marine mammals and seabirds, including rare or endangered fish species. Black Corals, Sea Pens, Small Gorgonians, Soft Corals and Stony Cup Corals are all found in parts of this EBSA in high concentrations. During the Campelen period, high densities of Witch Flounder, American Plaice, Atlantic Cod and Redfish were distributed throughout the EBSA. Several rare or endangered fish species (Spotted, Northern and Atlantic Wolffish, Skates and Roundnose Grenadier) were found throughout this EBSA in large concentrations during the Campelen period, with the Wolffish species heavily influencing the demarcation of the southwestern boundary. With the exception of planktivores and plankpiscivores, many of the fish functional groups were abundant throughout this EBSA during both Campelen and Engel periods.

Female Hooded Seals are found in this area from August to September, while Harp Seals feed here during the winter. Also, several seabird species (murres, storm petrels, Black-legged Kittiwake, Great Black-backed Gull, skuas and jaegers, Northern Fulmar, Greater Shearwater, Sooty Shearwater, Dovekie) have been known to frequent this area.

Bycatch data have shown that this area seems to be important to several species of sharks.

Coral bycatch has been recorded to 1,300 m depth in this area, and the Orphan Basin area to the east of this EBSA is known to be important for a diverse array of marine birds and other taxa. Although similar habitat types would be expected in the Orphan Basin based on the geomorphology of the area, data are generally limited beyond 1,000 m. Therefore further exploration into the ecological significance of this area is highly recommended if management action is contemplated.

Southern Pack Ice

Seasonal pack ice is a unique feature of the entire bioregion. Although ice provides an important habitat for a number of species throughout the NL Shelves Bioregion, the southern portion of the pack ice is particularly significant. The development and recession of the ice in this region influences a variety of important environmental and biological processes including changes in light penetration, wind driven mixing, salinity, and the timing and extent of the spring phytoplankton bloom. The extent of ice and time of retreat has also been shown to influence the population dynamics of capelin (Buren et al. 2014).

The southern part of the pack ice is the location of the main pupping concentrations of both Harp and Hooded Seals (Stenson et al. 1997, Stenson et al. 2003). Both species rely upon suitable ice extent and thickness to give birth and nurse their pups. Currently, ~70% of all harp seals and >90% of Hooded Seals in the northwest Atlantic give birth in the area although the proportions will likely increase if ice conditions in the Gulf of St. Lawrence continue to deteriorate.

The large concentration of seals using this area provides the basis for a complex ecosystem that includes a variety of marine scavengers, seabirds, including the Ivory Gull, and polar bears.

The bears travel to the area from northern Labrador and Baffin Island to feed intensively during March. The energy gained off southern Labrador maintains them for much of the year.

Unlike other EBSAs, the location of the southern pack ice is transitory and varies both within and among years, as it is influenced by winds and currents. However, it usually located south of Hamilton Inlet, as far south as Notre Dame Bay (Figure 15). Although it cannot be defined by rigid boundaries, the southern pack ice is an area that is highly productive and ecologically important within the NL shelves ecosystem and the North Atlantic.

Unsupported EBSAs

The following three EBSAs were candidate EBSAs proposed at the October 2012 CSAS meeting (Figure 4), however it was decided not to include them in the final list of EBSAs for various reasons, which are included in the descriptions below.

Deep Inlet

Deep Inlet is a fjord south of Hopedale that was proposed as being significant because it was the only area where significant concentrations of Bay Ducks were identified, making it unique. It also contains areas of high densities for Dabbling Ducks, Geese and Common Eider. Important areas for certain groundfish and pelagic fish species, as well as marine mammals, were identified within the proposed boundaries from CCRI data. During the peer review meeting it was stated that this unique aggregation was based on coastal waterfowl aerial surveys and there was not a huge amount of confidence in these data, given the small area covered by the surveys. Also, this area did not have any other significant features that would warrant identifying it as an EBSA. Additionally, it was suggested that the features for which it was identified may not persist over time. Therefore it was decided that it should not be labeled as an EBSA solely based on Bay Ducks and was removed from the list of final EBSAs.

St. Anthony Basin

The St. Anthony Basin area is a relatively small area of the shelf that deepens to 400 m and was proposed based on a high concentration of several core species and juvenile fish. Skates were found throughout the basin and adjacent shelf area in high densities during the Engel period. Shrimp were found in high densities on the outer edge of the basin and extending onto the shelf area. Snow Crab (Campelen period) and Greenland Halibut (both periods) were found in high densities inside the basin.

Female Hooded Seals feed in the area prior to whelping and it is also noted as the area of highest probability of whelping Hooded Seals in the northwest Atlantic. Telemetry data show that Harp Seals use the southern part of the St. Anthony basin EBSA for winter feeding, as well as areas south to Funk Island Bank. Also, a traditional whaling area was identified in the southwest portion of this EBSA, extending along the Middle Shelf. Thick-billed Murres, Northern Fulmars, Great Black-backed Gulls, and Black-legged Kittiwakes were found in high densities in this area, while several Seabird species were found just on the edges of the boundary.

As it was decided at the peer review meeting that juvenile fish data would not be used in the identification of EBSAs based on the limited scope of this dataset, this EBSA was rejected. Although this area is used by a number of species, once juvenile fish data layers were excluded, the significance of this area as being more important than others was diminished.

Trinity Trough

Trinity Trough is an area near the southern end of the study area that actually extends south of the study area boundary. High densities of several species of fish, including juveniles were found here. This area was originally separated from the Orphan Spur EBSA because it

represents a different habitat type in more shallow waters. Skates were found in high densities throughout this entire area during both the Campelen and Engel periods. Atlantic Wolffish were also found during both time periods, but were concentrated near the edges of the area. High densities of Spotted Wolffish were present in the area during the Campelen period, but high concentrations occurred just outside the area during the Engel period. American Plaice, Atlantic Cod, Piscivores, Snow Crab and Shrimp were found in high concentrations during the Campelen period, with Snow Crab being found in highest densities only near the southern part of the EBSA. Witch Flounder and Atlantic Cod were found in high densities during the Engel period, again noting that Snow Crab and Shrimp were not included in the Engel dataset. Finally, this area was also an important area for Common and Thick-billed Murres, based on satellite tagging data and kernel home range estimates. Storm Petrels were also found in high densities in this area during pelagic surveys.

The key characteristic of this proposed EBSA was the density of wolffish and Atlantic Cod in the area. However, it was noted during the peer review meeting that other areas (i.e. Orphan Spur) are considered more important for wolffish. The southwestern boundary of the Orphan Spur EBSA was expanded further to the west to incorporate a portion of the Atlantic Cod area [also known as the Bonavista corridor (Mello and Rose 2009)] and almost all of the area important for wolffish. The Trinity Trough was subsequently rejected as a separate EBSA.

DIVERSITY, RICHNESS AND EVENNESS

Diversity, richness and evenness indices were mapped for DFO RV survey data. These indices initially included all fish and invertebrate species in the survey data; however, given that the dominance of the core species was heavily influencing the results and obscuring the signal of less dominant species, these layers were recreated without the core species. When overlaying the candidate EBSAs on these layers, it became evident that the EBSAs identified during this process did indeed occur in many areas of high diversity, richness and evenness.

QUANTILE CLASSIFICATION ISSUES

Post meeting it was discovered that the ArcGIS quantile classification used to complete the significant area analyses had not performed as expected. A determination of the impact of this error on the methodology for determining EBSAs was required before finalizing the science advice.

ArcGIS quantile classification is designed to identify class breaks within a dataset such that each class contains an equal number of features. Each of the layers in the analysis was classified into 10 quantiles where each class was thought to have contained an approximately equal number of raster cells. The highest class in each layer was believed to have represented cell values above the upper 10^{th} percentile (i.e. top decile) of the data and subsequently used to identify 'significant' areas.

A post meeting re-analysis of the classified density surfaces determined that there was an uneven distribution of raster cells in each of the 10 quantile classes with a disproportionately large number of cells in the lowest quantile class owing to problems in the software.

The effect of this misclassification was an underestimation of the areas presented as the upper 10^{th} percentile for many of the data layers used in the analysis. Seabird data layers were not affected by the misclassification. ESRI, the manufacturer of the ArcGIS software, was approached about this issue, at which point it was identified as a software bug that the company is currently reviewing.

The severity of this issue varied between the layers where the upper quantiles presented and considered for various layers actually contained between 3.01% and 8.97% of raster cell values (as opposed to the full 10%), with the exception of planktivore and plankpiscivore functional groups during the Engel period (0.5% and 0.54% respectively), and Large Gorgonian Corals (1.35%). Notably, planktivores/plankpiscivores during the Engel timeframe were not defining elements for any EBSA, and therefore do not raise significant concern. A re-analysis of the significant areas for Large Gorgonians revealed that three out of the four areas that were in the upper tenth percentile were already captured by one of the EBSAs.

It is unclear as to how this issue with quantile classification would have affected the final size and shape of the EBSAs as this was largely determined during the peer review process. However, the difference in the end result is likely to be insignificant as the major features of the study area are still well captured. It is recognized that the areas of highest concentration for each data layer may have been underestimated with the original intended methodology, however, the total area covered by the EBSAs still represents >30% of the study area, which is comparable to the total area covered by EBSAs in other DFO Regions.

Following on best practice, should the decision be made to establish particular management measures for any of these EBSAs, the data remains available for re-examination at the scale of that particular EBSA, minimizing further any variability between expected and real results of the analysis undertaken here.

CONCLUDING REMARKS

Fifteen EBSAs were identified in three different categories throughout this process:

1. Three were in coastal areas;
2. Four were straddle coastal and offshore areas; and
3. Seven were in the offshore.

An additional EBSA is transitory and follows the southern extent of pack ice. 172 layers of biological data and an additional 38 layers of oceanographic and environmental data were used to define these significant areas, along with many hours of meetings with scientific experts in oceanography, ecosystem structure and function and taxa-specific life histories. While a variety of quantitative approaches were considered and debated, the Steering Committee concluded that comparing all of the layers in a qualitative way allowed for the identification of trends and significant areas of overlap. By using the uppermost class (i.e. quantile) for each data layer, the identification of areas that were most important for a multitude of species within the region was possible. This does not preclude the notion that areas other than those identified may be significant for individual species; rather, this approach identified areas that were significant to many species, and therefore the ecosystem as a whole.

In addition to the key characteristics we used to identify these EBSAs, a variety of other species are likely to occur in each of them. Identifying important areas for species that are widely distributed or move seasonally is difficult using the methods we employed. However, given that most of the areas identified are highly productive and important for a large number of species, it is likely that they are also important for highly mobile species such as seals, whales and seabirds.

Bathymetry was a key characteristic underlying the delineation of boundaries for many of the EBSAs. It was found that strong gradients in bathymetry had a large influence on the description and definition of the physical habitat, based on principal component and cluster analyses, because such features have strong influences on currents, as well as properties of the water

column. The strong association of many EBSAs with features associated with troughs and the continental slope indicates that a robust approach to define critical properties to be used for conservation measures would require a more comprehensive and detailed analysis of local features than was possible in this study.

The boundaries for each area were drawn based on the best available knowledge, using the relevant data that were available at the time of this review. It should be noted that marine organisms exhibit multiscale associations with their physical environment, however the processes that drive these associations are sometimes difficult to identify (Langton et a.. 1995). If one or more areas are selected for additional protection, they can be examined in greater detail to better identify the important characteristics and to determine the scale at which these features are associated with the area. This may require refinement of the boundaries.

Although naturalness and resilience are EBSA criteria, they are properties that are extremely difficult to quantify and/or map. Naturalness is often associated with a pristine state, prior to any human perturbation; and since the fisheries resources of the NL ecosystem were the original drivers of the European colonization and settlement in Newfoundland in the 1500s, any attempt to characterize an area as natural or pristine is bound to be somehow tarnished by 500 years of human use of this ecosystem. A study of the spatial patterns of trawling found that they were fairly stable during the 1980s while the greatest changes occurred during the early 1990s (Kulka and Pitcher 2001). There were numerous persistent areas of trawling spread mainly along the shelf edge and between the banks. Except for the Grand Bank and the Magdelen Shallows, the tops of most banks appeared mostly untrawled. However, this analysis was conducted prior to the development of shellfish fisheries in the region, and only considered bottom trawling during a relatively recent, although intense, period of the exploitation history of this ecosystem. In terms of resilience, this property refers to the ability of an area to withstand and/or quickly recover from perturbations. In this analysis, the data available did not allow any real attempt to quantify or characterize this property, although EBSAs defined on the basis of benthic ecosystem components (e.g. corals), would be expected to be far less resilient to perturbations than an areas defined by concentrations of mobile organisms like fish.

To conclude, the resulting EBSAs were identified on basis of a large and diverse database, which combined many different types and quality of data. Although other approaches than the one followed here can be used to identify EBSAS, the process implemented in this study was intended to be a balanced one that tried to make the most of each different data source available while preventing conclusions that were overly driven by those taxa for which more information was available, or by those regions that had been more often targeted by research efforts over time. The EBSAs identified here do not necessarily capture the most important areas for each and every individual ecosystem component, they are intended to capture the significant areas in the larger and broader ecosystem context.

ACKNOWLEDGMENTS

The authors would like to acknowledge the role of Steering Committee members and other scientists and staff from DFO Science and Oceans, the Canadian Wildlife Service and Memorial University in guiding the process of data collection, processing and analysis. They also played a key role in guiding the development of methods to identify and delineate EBSAs using spatial analytical techniques. We would also like to acknowledge Margaret Warren for her assistance with the creation of maps for the final version of this report.

Steering committee members: Bill Brodie, Neil Ollerhead, Fran Mowbray, Vanessa Sutton-Pande, Nadine Templeman, Mardi Gullage, Kent Gilkinson, Robert Gregory.

Other important contributors: Brian Dempson, Karel Allard, Jack Lawson, Tony Bowdring, Vonda Wareham, Fraser Davidson, Brian Nakashima, Joanne Morgan, Annette Anthony, Bill Montevecchi, George Rose, Sabina Wilhelm, Sigrid Kuehnemund, Dave Orr, Becky Sjare, Kate Dalley, Laura Park, Annette Power, Martha Robertson, Eugene Murphy, Don Stansbury, Geoff Veinott, Mark Simpson, April Hedd, Chantelle Burke.

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TABLES

Table 1a: List of coastal data layers indicating groupings into conceptual layers.

Layer Group	Data Layers
Fish	• Charr Landings • Salmon Total Returns • Salmon Drift Net Surveys • Capelin spawning areas
Waterfowl maximum counts	• Harlequin Duck • Barrow's Goldeneye • Seaducks • Geese • Dabbling Ducks • Bay Ducks
Eider surveys	• Common Eiders • Black Guillemots
Seabird Colonies	• Common Murre • Glaucous Gull • Great Black-backed Gull • Herring Gull • Northern Fulmar • Northern Gannet • Atlantic Puffin • Razorbill • Terns • Thick-billed Murre
CCRI Groundfish	• American plaice • Atlantic cod • Brook trout • Charr • Flounder • Greenland cod • Halibut • Lumpfish • Redfish • Rock cod • Salmon • Skate • Smelt • Turbot • Winter flounder • Witch flounder • Wolffish
CCRI Pelagics	• Arctic char • Atlantic salmon • Brook trout • Brown trout • Eel • Herring • Mackerel • Salmon • Shark • Smelt • Tuna

Table 1a: Continued.

Layer Group	Data Layers
CCRI Shellfish	• Clam • Giant scallop • Lobster • Mussel • Rock crab • Sea urchin • Shrimp • Snail • Snow crab • Soft shell clam • Squid • Toad crab • Whelk
CCRI Aquatic Plants	• Eelgrass • Goose grass • Irish moss • Kelp • Rockweed • Seagrass

Table 1b: List of offshore data layers indicating groupings into conceptual layers. All offshore data layers were included in the composite layer with the exception of the environmental data layers, which were included in the PCA and k-means clustering analysis.

Layer Group	Data Layers
Corals and Sponges	• Large gorgonians • Small gorgonians • Stony cup corals • Black corals • Sea pens • Soft corals • Sponges
Core Species, Campelen	• Capelin • Witch flounder • American plaice • Cod • Redfish • Turbot • Crab • Shrimp
Core Species, Engel	• Capelin Acoustic Data • Witch flounder • American plaice • Cod • Redfish • Turbot
SARA Species, Campelen	• Roundnose grenadier • Skate • Northern wolffish • Spotted wolffish • Atlantic wolffish
SARA Species, Engel	• Roundnose grenadier • Skate • Northern wolffish • Spotted wolffish • Atlantic wolffish
Functional Groups, Campelen	• Small benthivores • Medium benthivores • Large benthivores • Planktivores • PlankPiscivores • Piscivores
Functional Groups, Engel	• Small benthivores • Medium benthivores • Large benthivores • Planktivores • PlankPiscivores • Piscivores
Juvenile Areas, Engel	• Atlantic Cod • American Plaice • Greenland Halibut • Witch Flounder
Spawning Areas, Engel	• Atlantic Cod • American Plaice

Table 1b: Continued.

Layer Group	Data Layers
Juvenile Areas, Campelen	• Atlantic Cod • American Plaice • Greenland Halibut • Witch Flounder
Spawning Areas, Campelen	• Atlantic Cod • American Plaice
Marine Mammals	• Eastern Hudson Bay Belugas • Historical Whaling Data • Harp Seal Whelping • Harp Seal Feeding • Hooded Seal Whelping • Hooded Seal Movement (Males August-February; Juveniles August-February; Females April-June; Females August-February) • Cetacean Surveys
Pelagic Bird Transect Survey Data	• Atlantic Puffins • Black-legged Kittiwake • Cormorants • Cory's Shearwater • Dovekie • Great Black-backed Gull • Greater Shearwater • Herring Gull • Ivory Gull • Murres • Northern Fulmar • Phalaropes • Razorbill • Skuas & Jaegers • Sooty Shearwater • Storm Petrels • Terns
Buffered colonies	• Atlantic Puffin • Common Murre • Glaucous Gull • Great Black-backed Gull • Herring Gull • Northern Fulmar • Northern Gannet • Razorbill • Terns • Thick-billed Murre
Murre Distributions	• Common Murre (Fall; Early Winter; Late Winter) • Thick-billed Murre (Fall; Early Winter; Late Winter; Spring)

Table 1b: Continued.

Layer Group	Data Layers
Environmental Data	• Pack Ice Duration • Sea Surface Temperature (Summer; Fall; Winter; Spring) • Sea Bottom Temperature (Summer; Fall; Winter; Spring) • Sea Surface Salinity (Summer; Fall; Winter; Spring) • Sea Bottom Salinity (Summer; Fall; Winter; Spring) • Bottom Current Velocity (Summer; Fall; Winter; Spring) • Surface Current Velocity (Summer; Fall; Winter; Spring) • Chlorophyll-a (Summer; Fall; Winter; Spring) • Primary Production (Summer; Fall; Winter; Spring • Bathymetric Complexity • Bathymetry

Table 2: List of Coastal EBSAs indicating features defined using Uniqueness, Aggregation and Fitness Consequences criteria, as well as presence of rare or endangered species. A list of acronyms for species names is found at the end of the table. Key biological features used to delineate the EBSA boundaries are indicated with a '' symbol.*

EBSA (NAFO Div)	Uniqueness	Aggregation	Fitness Consequences	Rare or endangered species
Nain Area (2H)	• Thick-billed Murre colony*	• Waterfowl* • Seabirds* • Capelin* • Arctic Charr*	• Common Eider colonies* • Seabird colonies* • Capelin spawning* • Spawning salmon	-
Lake Melville (2J)	• Brackish waters*	• Sea ducks* • Geese • Thorny Skate • Atlantic Tomcod • Laval's Eelpout • Arctic Eelpout • Sculpin • Atlantic Sturgeon • Harbour Seals	• Brook Trout • Rainbow Smelt • Sea Run Trout • Atlantic Salmon • Surf Scoters • Ringed Seals • Minke Whales • Humpback Whales • Dolphins • Harp Seals	-
Gilbert Bay (2J)	• Genetically distinct resident population of Atlantic Cod*	• Arctic Charr • Atlantic Salmon • Capelin • Soft corals • Seabirds	• Genetically distinct resident population of Atlantic cod* • Capelin	-

Table 3: List of Coastal and Offshore EBSAs indicating features defined using Uniqueness, Aggregation and Fitness Consequences criteria, as well as presence of rare or endangered species. A list of acronyms for species names is found at the end of the table. Key biological features used to delineate the EBSA boundaries are indicated with an '' symbol.*

EBSA (NAFO Div)	Uniqueness	Aggregation	Fitness Consequences	Rare or endangered species
Northern Labrador (2G)	• Barrow's Goldeneye* • Belugas* • PlankPiscivores	• Arctic Charr* • Barrow's Goldeneye* • Harlequin Duck* • Common Eider • Seabirds • Belugas* • Medium Benthivores • PlankPiscivores	• Barrow's Goldeneye* • Harlequin Duck* • Seabird colonies • Belugas overwintering area*	• Barrow's Goldeneye* • Belugas* • Harlequin Duck*
Hamilton Inlet (2H)	• Dabbling Ducks • Atlantic Puffin* • Razorbill* • Northern Fulmar	• Harlequin Duck • Waterfowl • Seabirds • Capelin* • Salmon* • Harp seals	• Harlequin Duck • Common Eider • Seabird colonies* • Salmon* • Capelin*	• Harlequin Duck
Grey Islands (3K)	-	• Harlequin Duck* • Sea ducks* • Waterfowl* • Seabirds* • Soft Corals • Small Gorgonians • Capelin • Snow crab • American plaice • Planktivores • Hooded Seals	• Harlequin Duck* • Seabird colonies*	• Harlequin Duck*
Fogo Shelf (3K)	• Common Murre* • Northern Fulmar* • Northern Gannet*	• Waterfowl* • Seabirds* • Salmon* • Capelin* • Small Benthivores • Atlantic Cod • Cetaceans* • Hooded Seals • Harp Seals	• Seabird colonies* • Capelin* • Salmon*	-

Table 4: List of Offshore EBSAs indicating features defined using Uniqueness, Aggregation and Fitness Consequences criteria, as well as presence of rare or endangered species. A list of acronyms for species names is found at the end of the table. Key biological features used to delineate the EBSA boundaries are indicated with an '' symbol.*

EBSA (NAFO Div)	Uniqueness	Aggregation	Fitness Consequences	Rare or endangered species
Outer Shelf Saglek Bank (2G)	• Large Gorgonians* • Sponges*	• Sea Pens* • Large Gorgonians* • Sponges* • Roundnose Grenadier • Harp Seals* • Hooded Seals* • Cetaceans* • Seabirds* • Ivory Gull*	• Large Gorgonians* • Roundnose Grenadier • Ivory Gull*	• Roundnose Grenadier • Ivory Gull*
Outer Shelf Nain Bank (2H)	-	• Sea Pens* • Black Corals* • Stony Cup Corals* • Small Benthivores* • Medium Benthivores* • Planktivores* • Hooded Seals* • Harp Seals • Seabirds* • Ivory Gull*	• Ivory Gull*	• Ivory Gull*

Table 4: Continued.

EBSA (NAFO Div)	Uniqueness	Aggregation	Fitness Consequences	Rare or endangered species
Hopedale Saddle (2H)	• Belugas*	• Sea Pens • Soft Corals • Small Gorgonians • Skates • Atlantic Wolffish • Roundnose Grenadier • Shrimp • Greenland Halibut • Redfish • Small Benthivores • Medium Benthivores • PlankPiscivores • Planktivores • Piscivores • Belugas* • Harp Seals • Hooded Seals • Seabirds • Ivory Gull	• Skates • Atlantic Wolffish • Belugas overwintering area* • Ivory Gull	• Skates • Atlantic Wolffish • Spotted Wolffish • Belugas* • Ivory Gull
Labrador Marginal Trough (2J)	-	• Spotted Wolffish • Northern Wolffish • Shrimp* • Snow Crab* • Greenland Halibut* • American Plaice* • Witch Flounder* • Capelin* • PlankPiscivores • Small Benthivores* • Medium Benthivores • Large Benthivores • Hooded Seals • Harp Seals* • Cetaceans* • Seabirds • Ivory Gull	• Spotted Wolffish • Northern Wolffish • Ivory Gull	• Spotted Wolffish • Northern Wolffish • Ivory Gull

Table 4: Continued.

EBSA (NAFO Div)	Uniqueness	Aggregation	Fitness Consequences	Rare or endangered species
Labrador Slope (2HJ)	• Sponges* • Planktivores* • Piscivores* •	• Soft Corals* • Black Corals* • Sponges* • Atlantic Wolffish* • Spotted Wolffish* • Northern Wolffish* • Roundnose Grenadier* • Skates* • Shrimp* • Greenland Halibut* • Redfish* • Atlantic Cod* • American Plaice* • Small Benthivores* • Medium Benthivores* • Large Benthivores* • Planktivores* • PlankPiscivores* • Piscivores* • Cetaceans • Harp Seals • Hooded Seals • Seabirds • Ivory Gull	• Atlantic Wolffish* • Spotted Wolffish* • Northern Wolffish* • Roundnose Grenadier* • Skates* • Ivory Gull	• Atlantic Wolffish* • Spotted Wolffish* • Northern Wolffish* • Roundnose Grenadier* • Skates* • Ivory Gull

Table 4: Continued.

EBSA (NAFO Div)	Uniqueness	Aggregation	Fitness Consequences	Rare or endangered species
Labrador Marginal Trough (2J)	• -	• Spotted Wolffish • Northern Wolffish • Shrimp* • Snow Crab* • Greenland Halibut* • American Plaice* • Witch Flounder* • Capelin* • PlankPiscivores • Small Benthivores* • Medium Benthivores • Large Benthivores • Hooded Seals • Harp Seals* • Cetaceans* • Seabirds • Ivory Gull	• Spotted Wolffish • Northern Wolffish • Ivory Gull	• Spotted Wolffish • Northern Wolffish • Ivory Gull
Notre Dame Channel (3K)	• -	• Skates* • Capelin* • American Plaice* • Greenland Halibut* • Snow Crab* • Shrimp* • Witch Flounder* • Redfish* • Planktivores • Harp Seals • Cetaceans* • Seabirds	• Skates*	• Skates*

Table 4: Continued.

EBSA (NAFO Div)	Uniqueness	Aggregation	Fitness Consequences	Rare or endangered species
Orphan Spur (3K)	• Atlantic Cod* • Witch Flounder* • Corals diversity*	• Soft Corals* • Sea Pens* • Black Corals* • Stony Cup Corals* • Small Gorgonians* • Roundnose Grenadier* • Skates* • Northern Wolffish* • Spotted Wolffish* • Atlantic Wolffish* • Witch Flounder* • American Plaice* • Atlantic Cod* • Redfish* • Small Benthivores* • Medium Benthivores* • Large Benthivores* • Piscivores* • Hooded Seals • Harp Seals • Seabirds	• Roundnose Grenadier* • Skates* • Northern Wolffish* • Spotted Wolffish* • Atlantic Wolffish*	• Roundnose Grenadier* • Skates* • Northern Wolffish* • Spotted Wolffish* • Atlantic Wolffish*

Table 5: Physical features, size (km^2) and heterogeneity of Coastal EBSAs. Heterogeneity is described in terms of the number of distinct areas within a given EBSA boundary.

EBSA (NAFO Div)	Physical Features	EBSA Size (km^2)	Heterogeneity of the EBSA
Nain Area (2H)	Webb Bay, Tikkoatokak Bay, Nain Bay, Anaktalik Bay, Voisey Bay, Fraser River	6,007.20	A few distinct areas
Lake Melville (2J)	Saltwater tidal extension of Hamilton Inlet; includes Lake Melville, narrows to Double Mer, and The Backway	3,049.52	A few distinct areas
Gilbert Bay (2J)	Shallow-water low-gradient, sub-arctic fjord; includes Gilbert Bay and Alexis Bay	358.37	A few distinct areas

Table 6: Physical features, size (km^2) and heterogeneity of Coastal and Offshore EBSAs. Heterogeneity is described in terms of the number of distinct areas within a given EBSA boundary.

EBSA (NAFO Div)	Physical Features	EBSA Size (km^2)	Heterogeneity of the EBSA
Northern Labrador (2G)	Inner, middle shelf, Saglek Bank; Cape Chidley to Saglek Bay	19,829.65	A few distinct areas
Hamilton Inlet (2H)	Hamilton Inlet including adjacent coastal and inner shelf area; Sandwich Bay	11,000.73	Many distinct areas
Grey Islands (3K)	Hare Bay; Grey Islands; inner shelf southeast towards Fogo Island	11,284.50	Many distinct areas
Fogo Shelf (3K)	Bay of Exploits to North Twillingate Island; Fogo Island; Cape Freels; inner shelf area	9,403.36	Many distinct areas

Table 7: Physical features, size (km^2) and heterogeneity of Offshore EBSAs. Heterogeneity is described in terms of the number of distinct areas within a given EBSA boundary.

EBSA (NAFO Div)	Physical Features	EBSA Size (km^2)	Heterogeneity of the EBSA
Outer Shelf Saglek Bank (2G)	Outer shelf of Saglek Bank, Labrador Slope	24,576.48	A few distinct areas
Outer Shelf Nain Bank (2H)	Outer shelf of Nain Bank, Labrador Slope	7,437.23	A few distinct areas
Hopedale Saddle (2H)	Hopedale Saddle, Labrador Marginal Trough, Nain Bank high point	27,263.35	A few distinct areas
Labrador Slope (2HJ)	Labrador Slope, outer shelf, Hamilton Spur	29,758.89	Many distinct areas
Labrador Marginal Trough (2J)	Cartwright Saddle, Labrador Marginal Trough, Hawke Saddle, inside Hamilton Bank	16,933.26	Many distinct areas
Notre Dame Channel (3K)	Notre Dame Channel, middle shelf	6,232.11	A few distinct areas
Orphan Spur (3K)	Orphan Spur, outer shelf, Labrador Slope	21,686.31	Many distinct areas

FIGURES

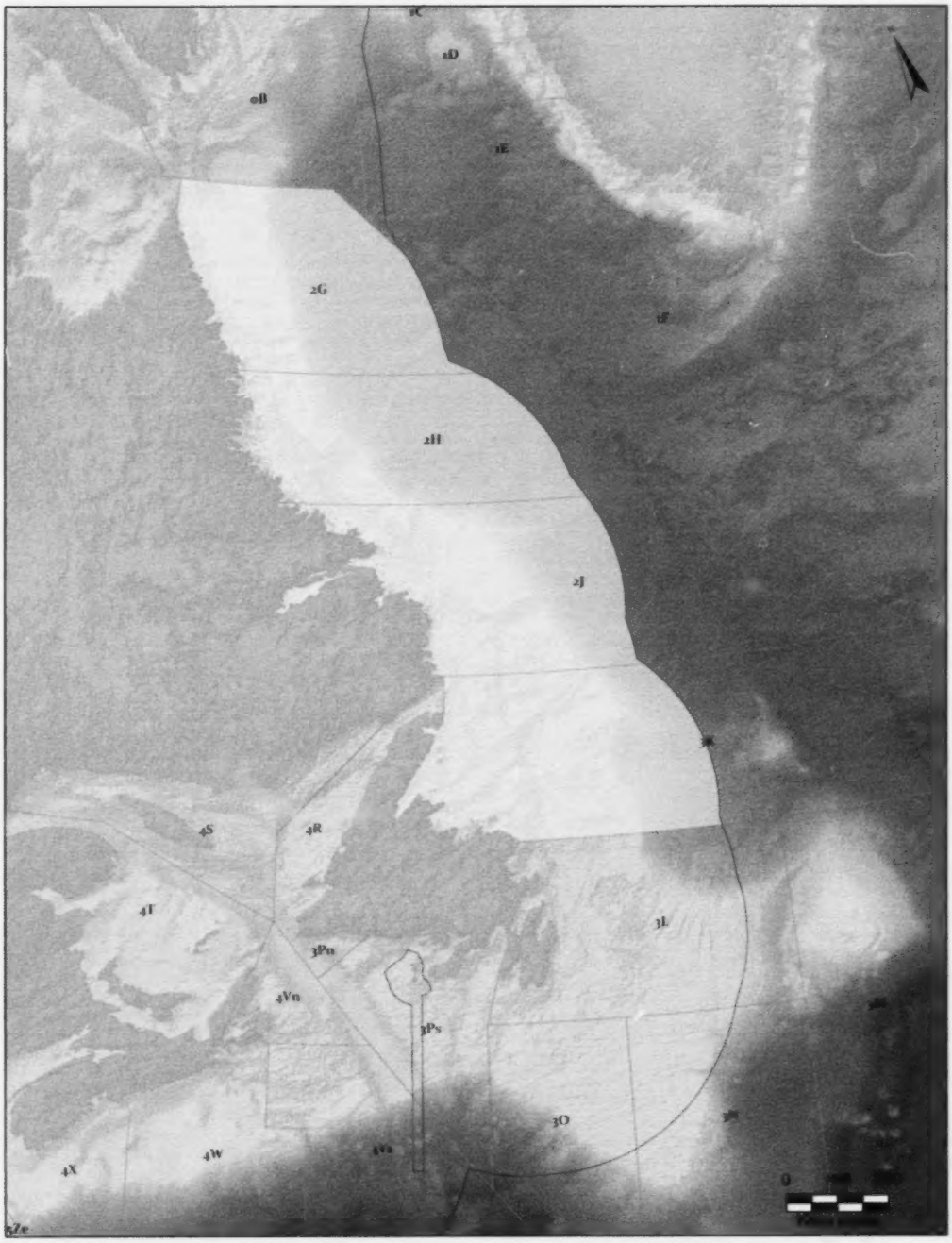

Figure 1: Study area for the NL Shelves Bioregion EBSA identification process.

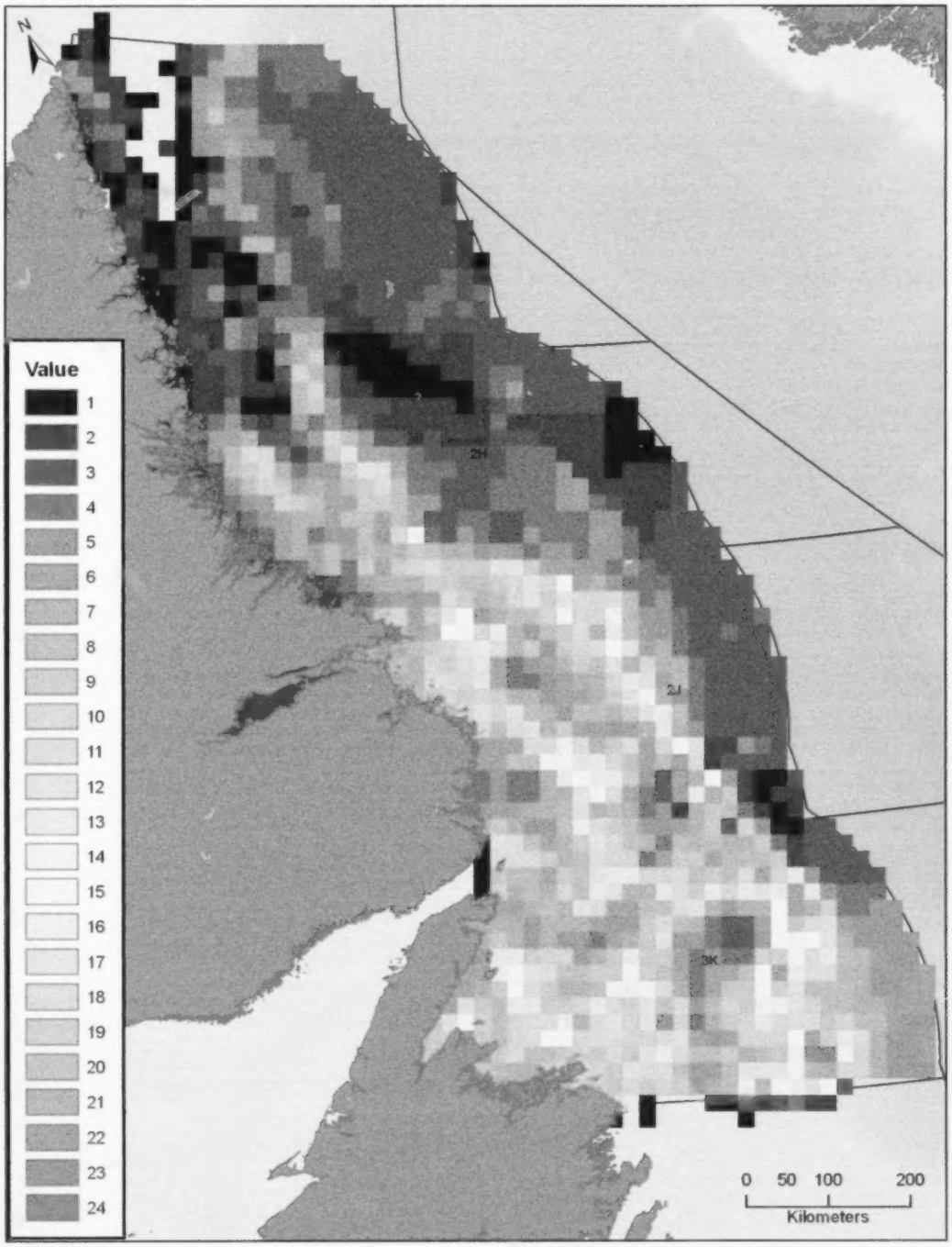

Figure 2: Cell statistics for Composite Layer (all data layers combined, except coastal).

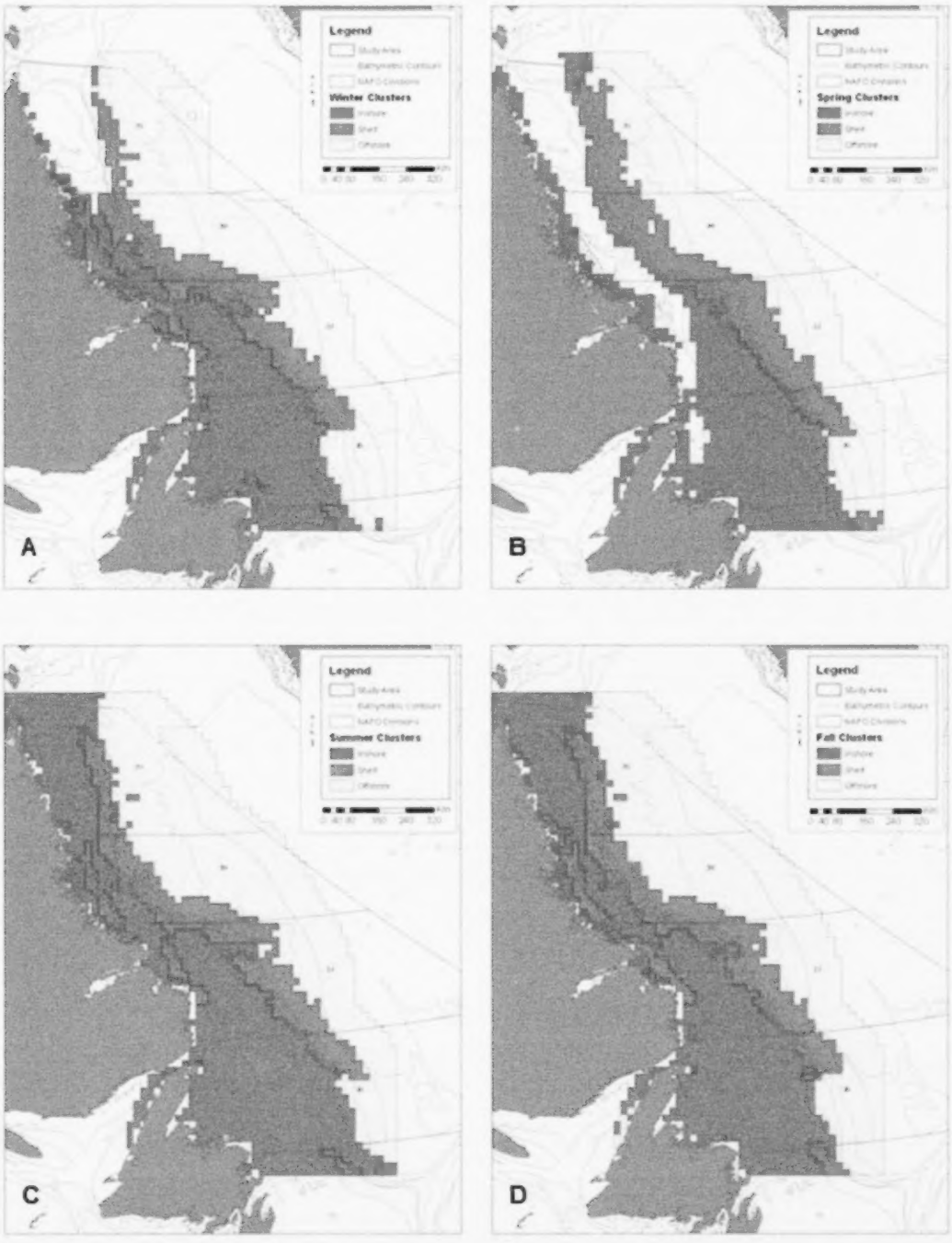

Figure 3: Results of the PCA and Clustering Analysis performed on oceanographic and bathymetric data for winter (A), spring (B), summer (C) and fall (D).

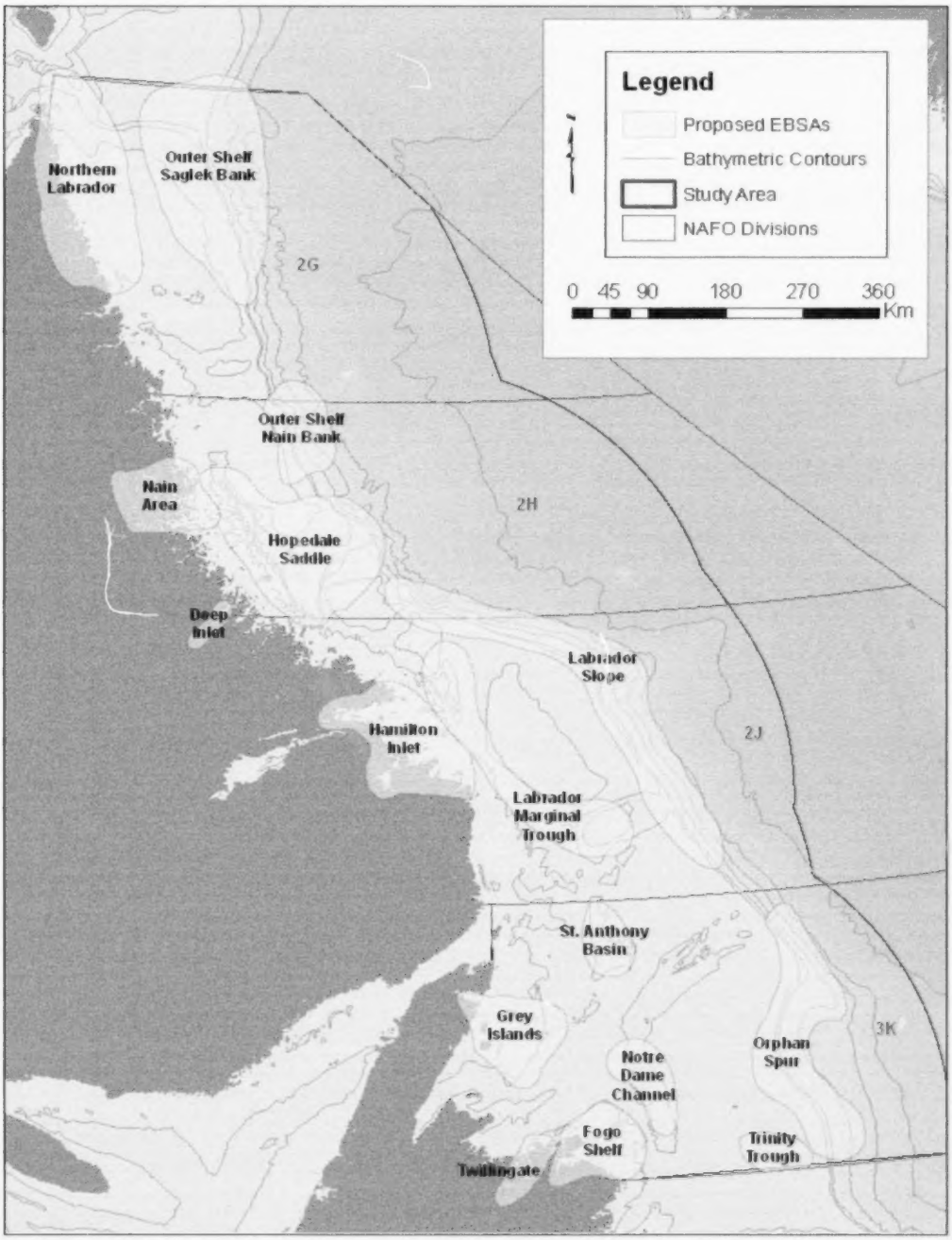

Figure 4: Map indicating candidate EBSAs proposed by the Steering Committee at the onset of the CSAS peer review meeting for the NL Shelves Bioregion.

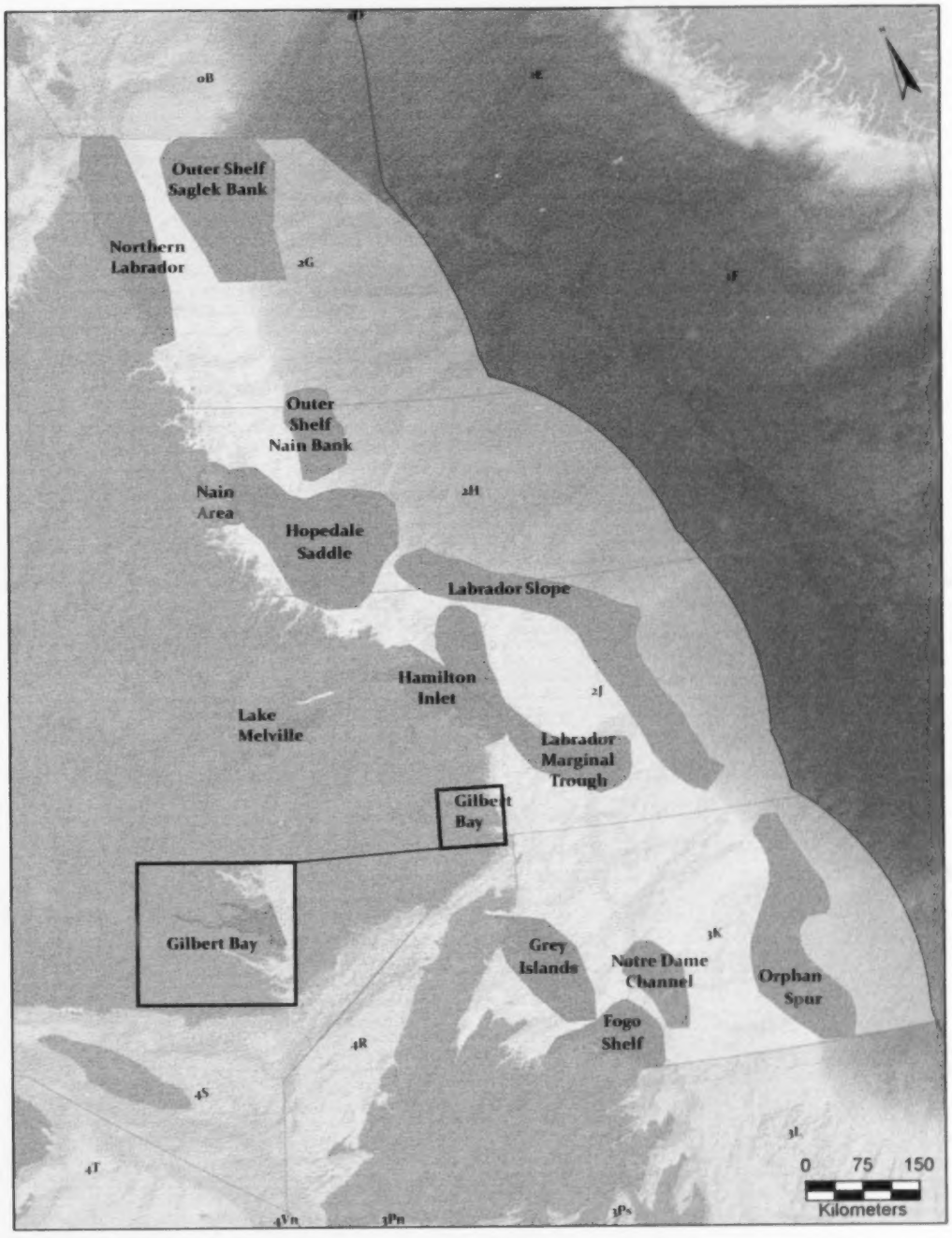

Figure 5: Map indicating final EBSAs for the NL Shelves Bioregion.

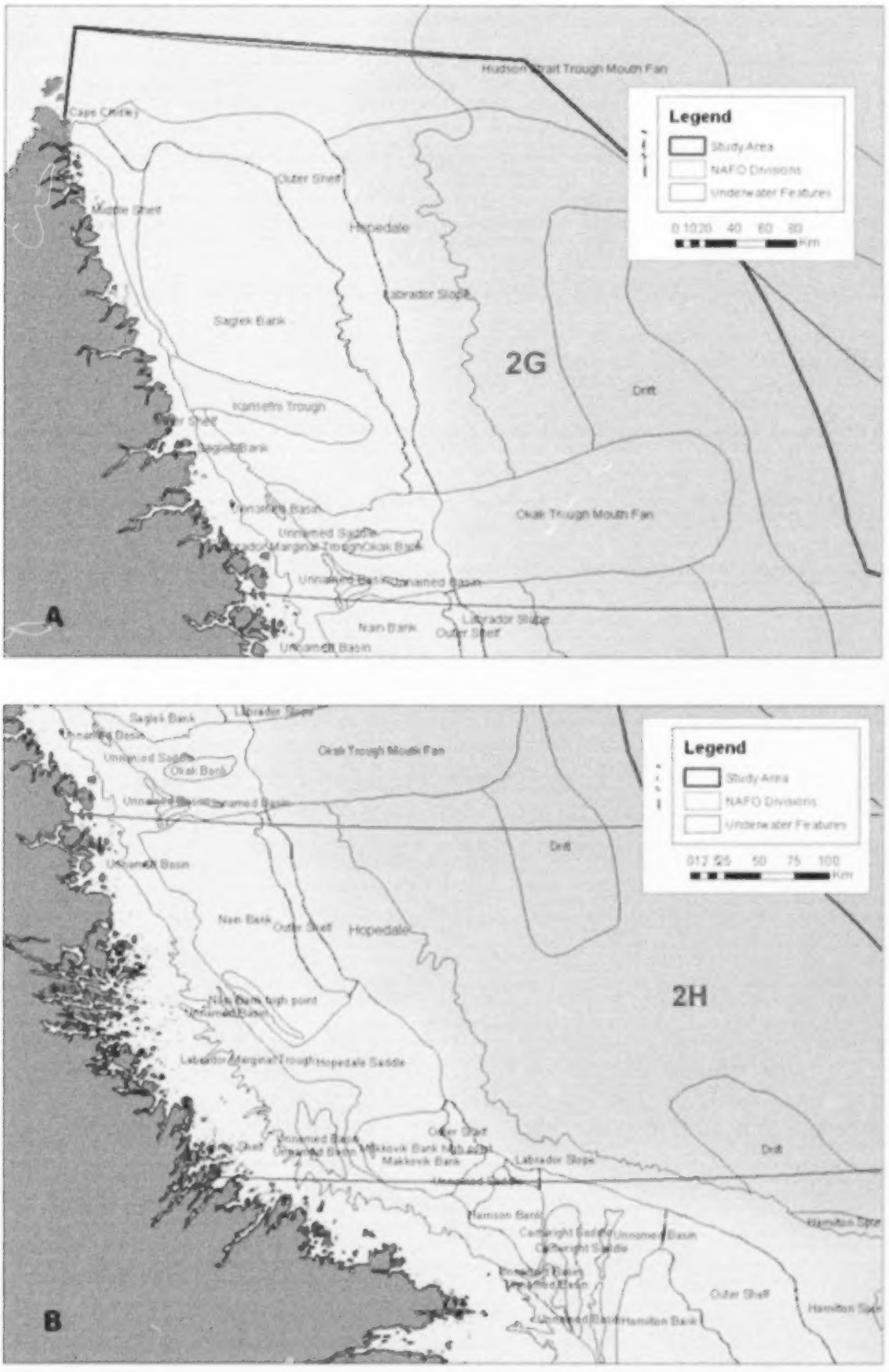

Figure 6: Underwater features of the NL Shelves Bioregion in NAFO Divisions 2G (A) and 2H (B).

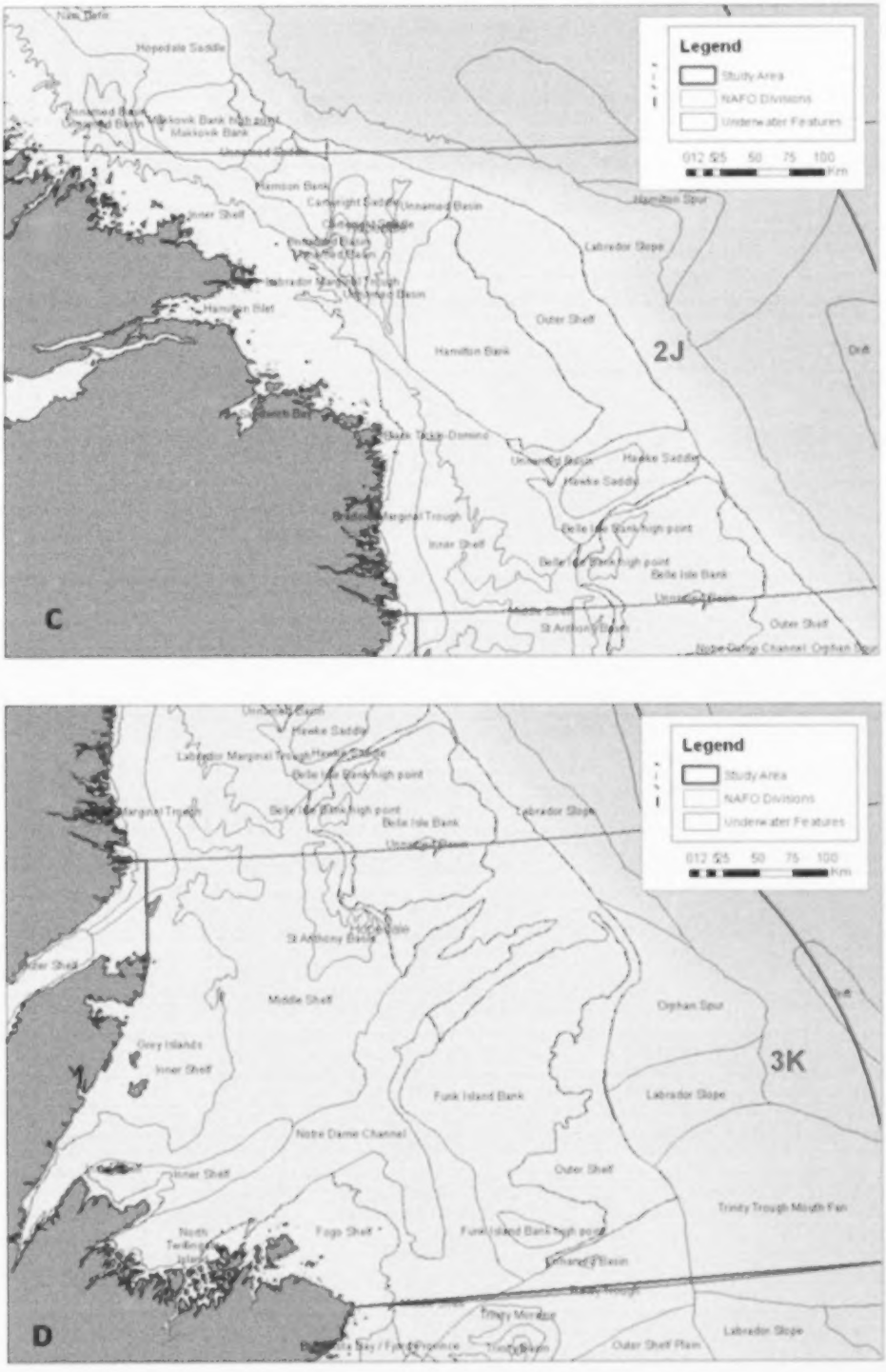

Figure 6: Continued - Underwater features of the NL Shelves Bioregion in NAFO Divisions 2J (C) and 3K (D).

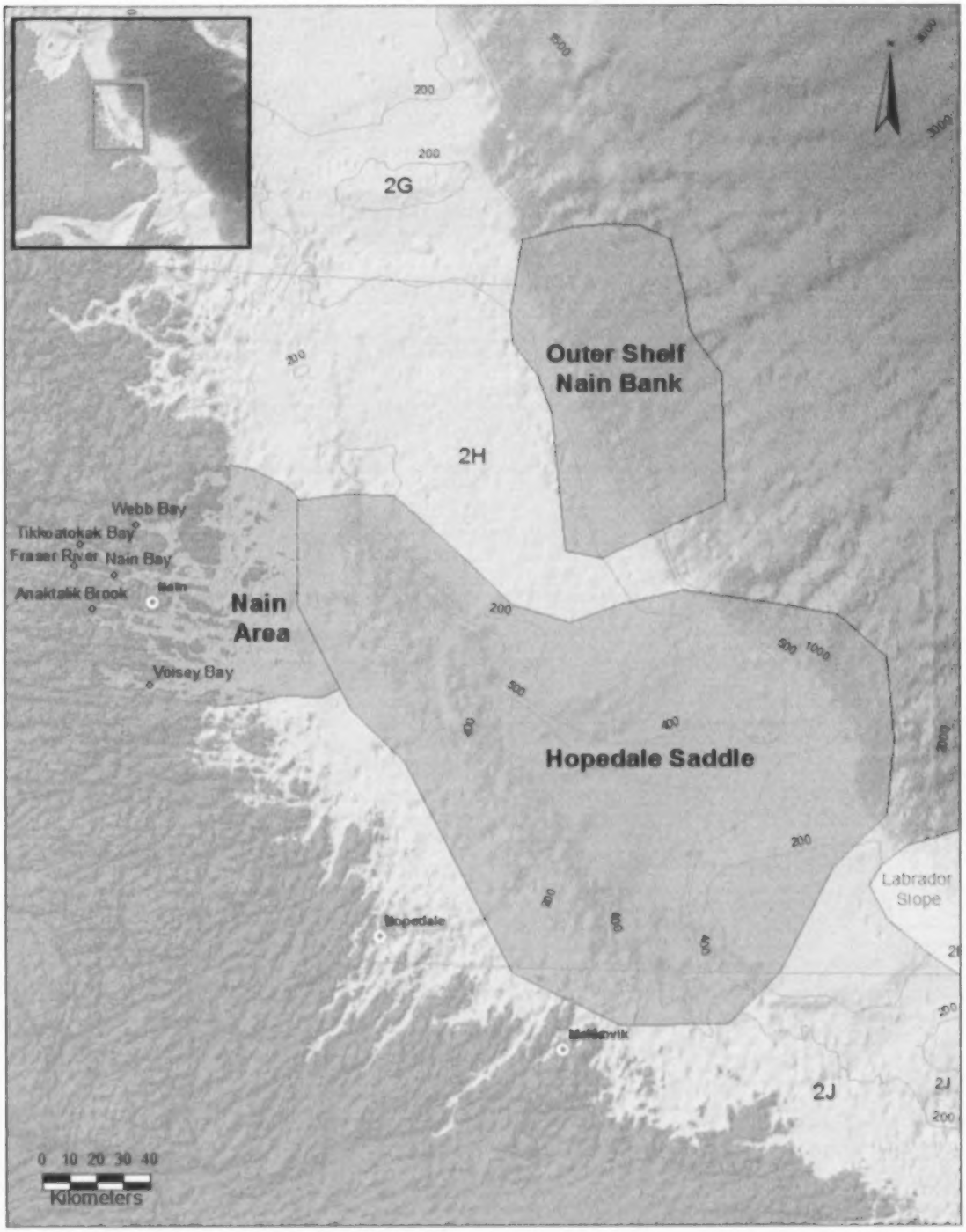

Figure 7: Expanded view of Nain Area, Hopedale Saddle and Outer Shelf Nain Bank EBSAs.

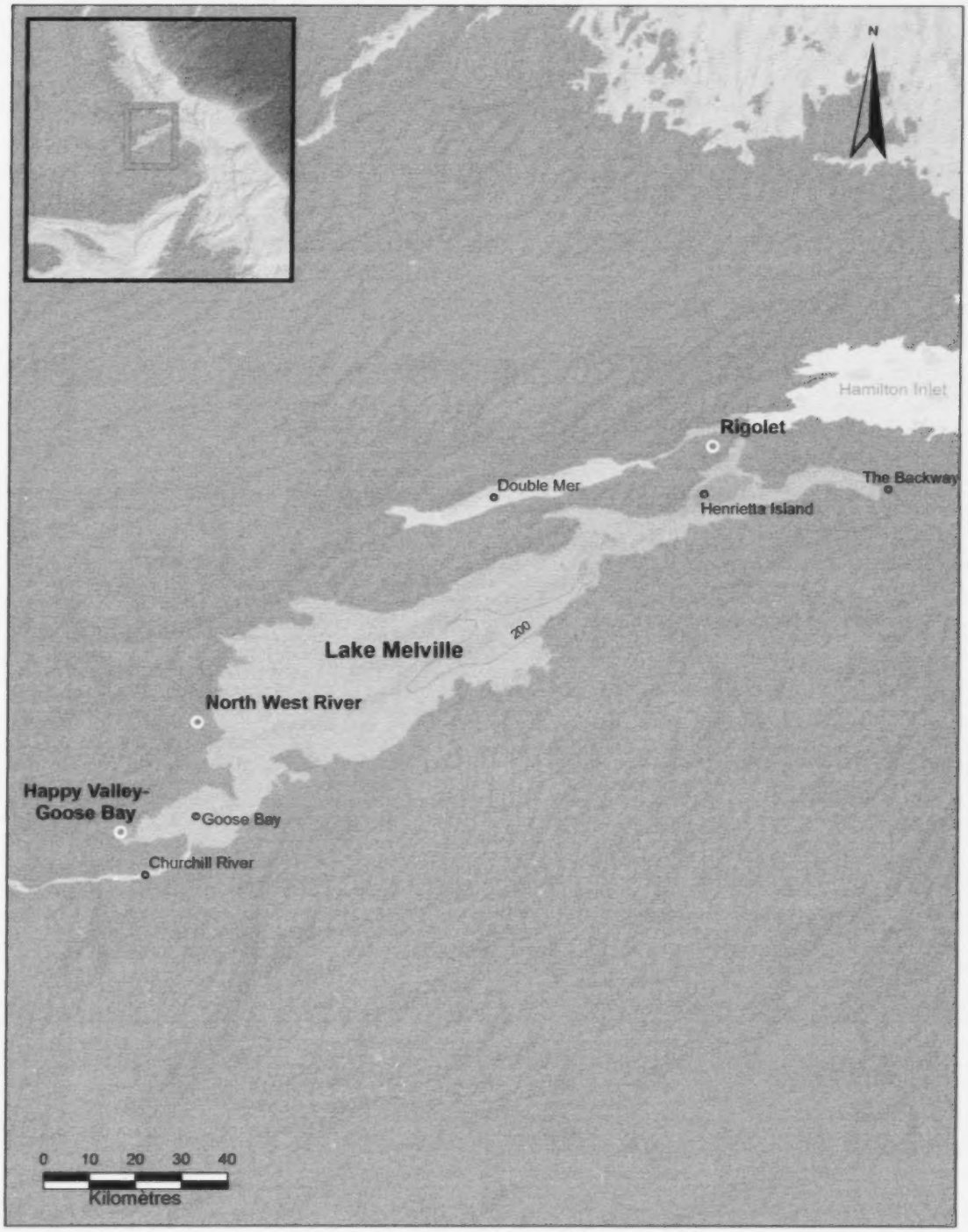

Figure 8: Expanded view of Lake Melville EBSA.

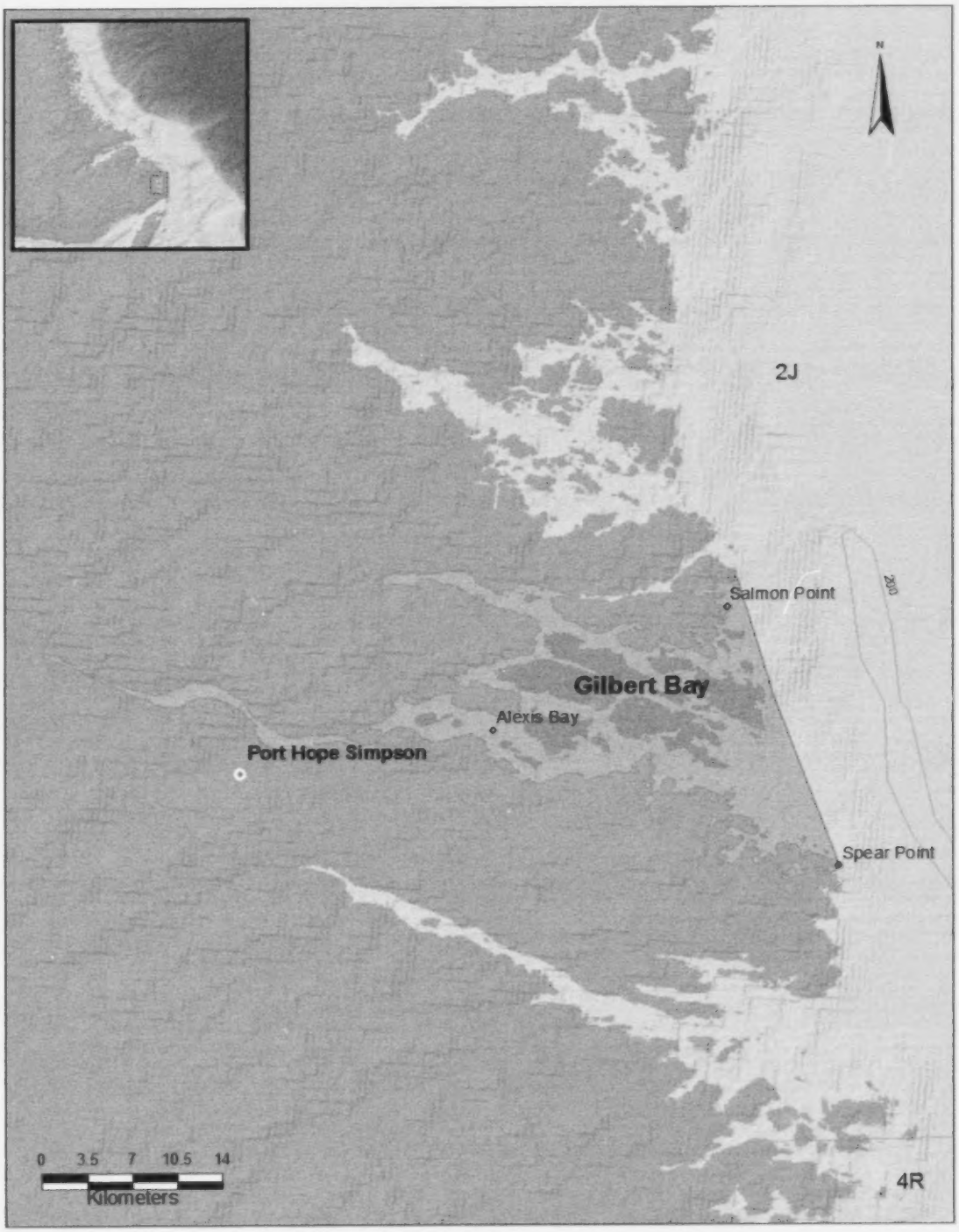

Figure 9: Expanded view of Gilbert Bay EBSA.

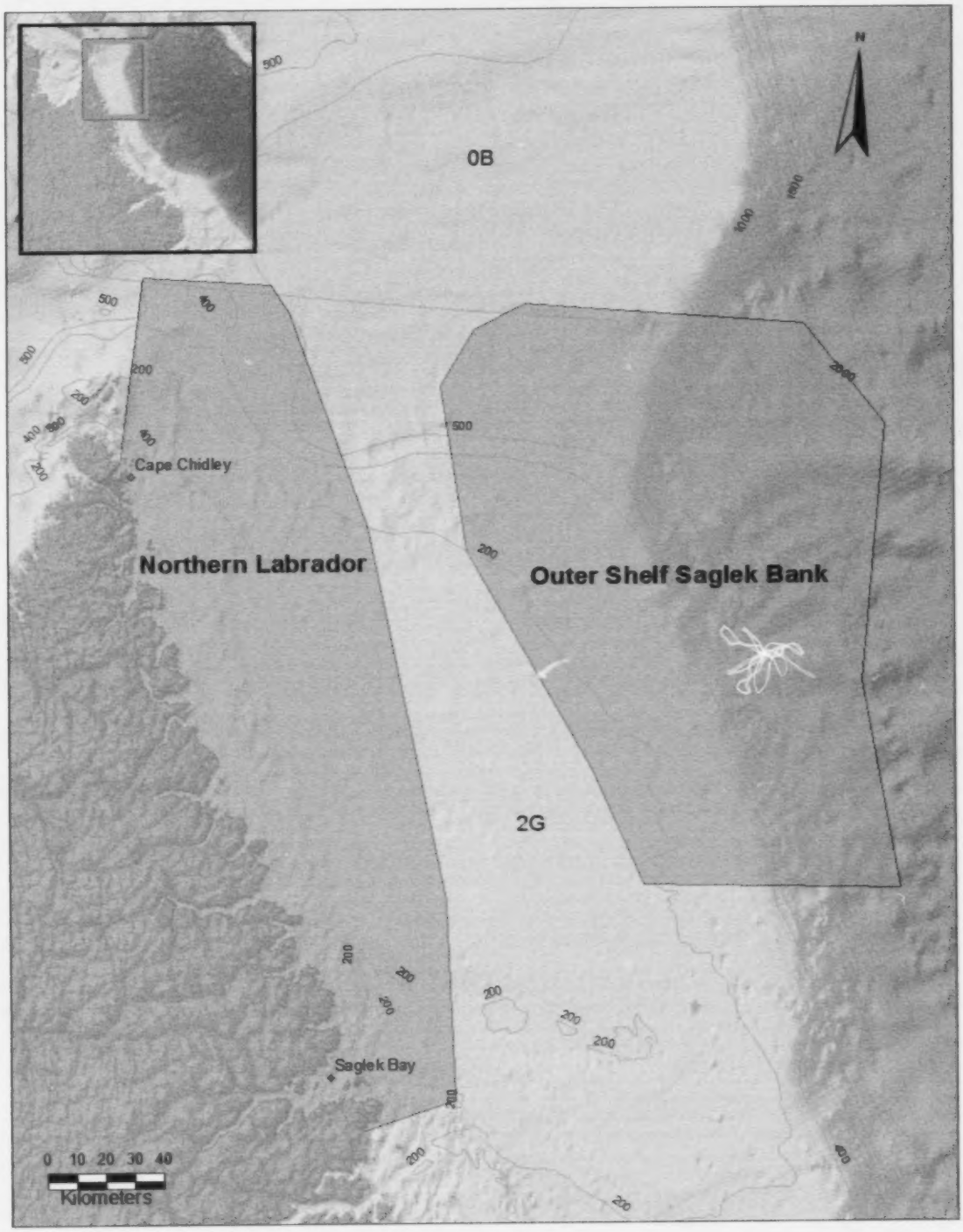

Figure 10: Expanded view of Northern Labrador and Outer Shelf Saglek Bank EBSAs.

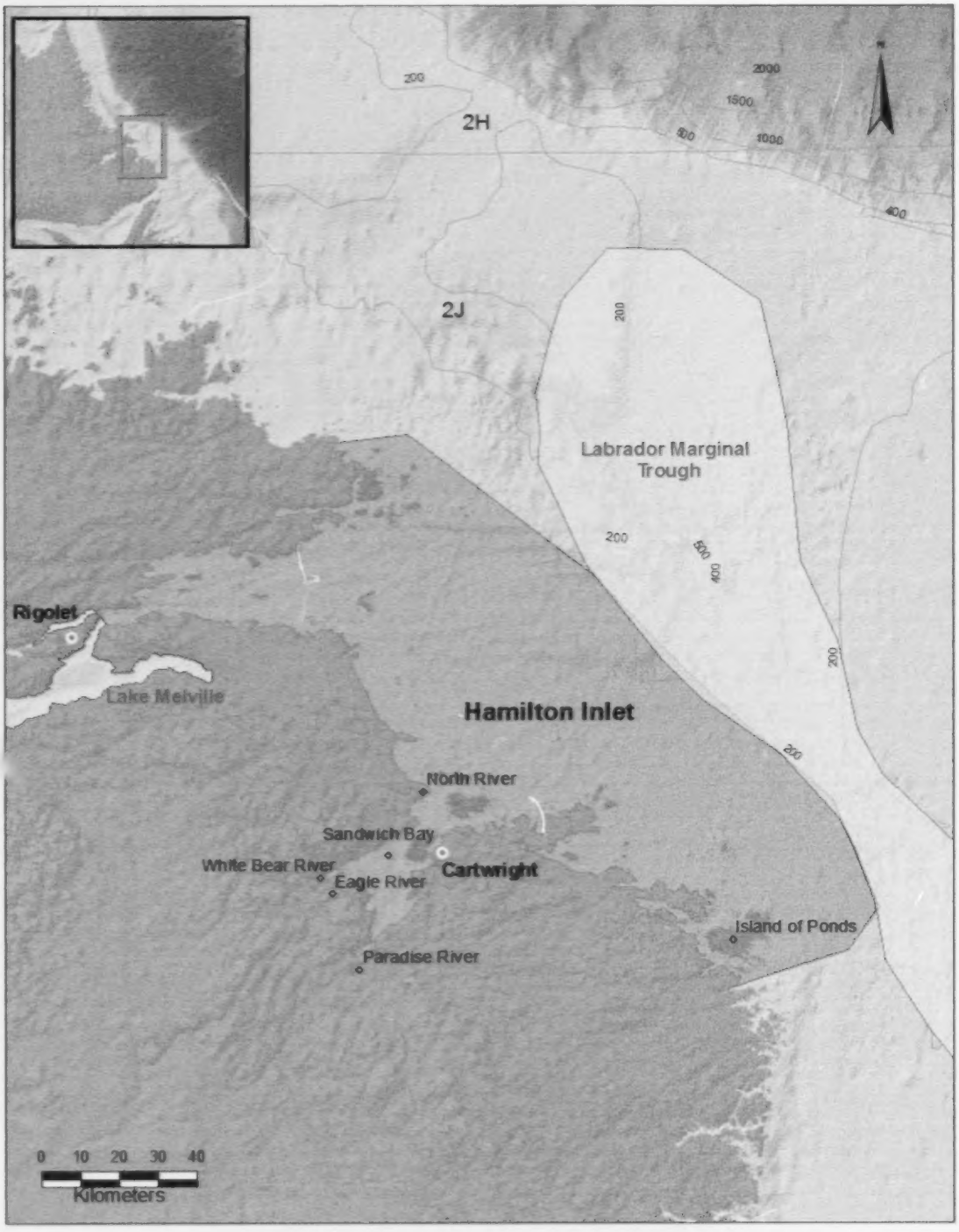

Figure 11: Expanded view of Hamilton Inlet EBSA.

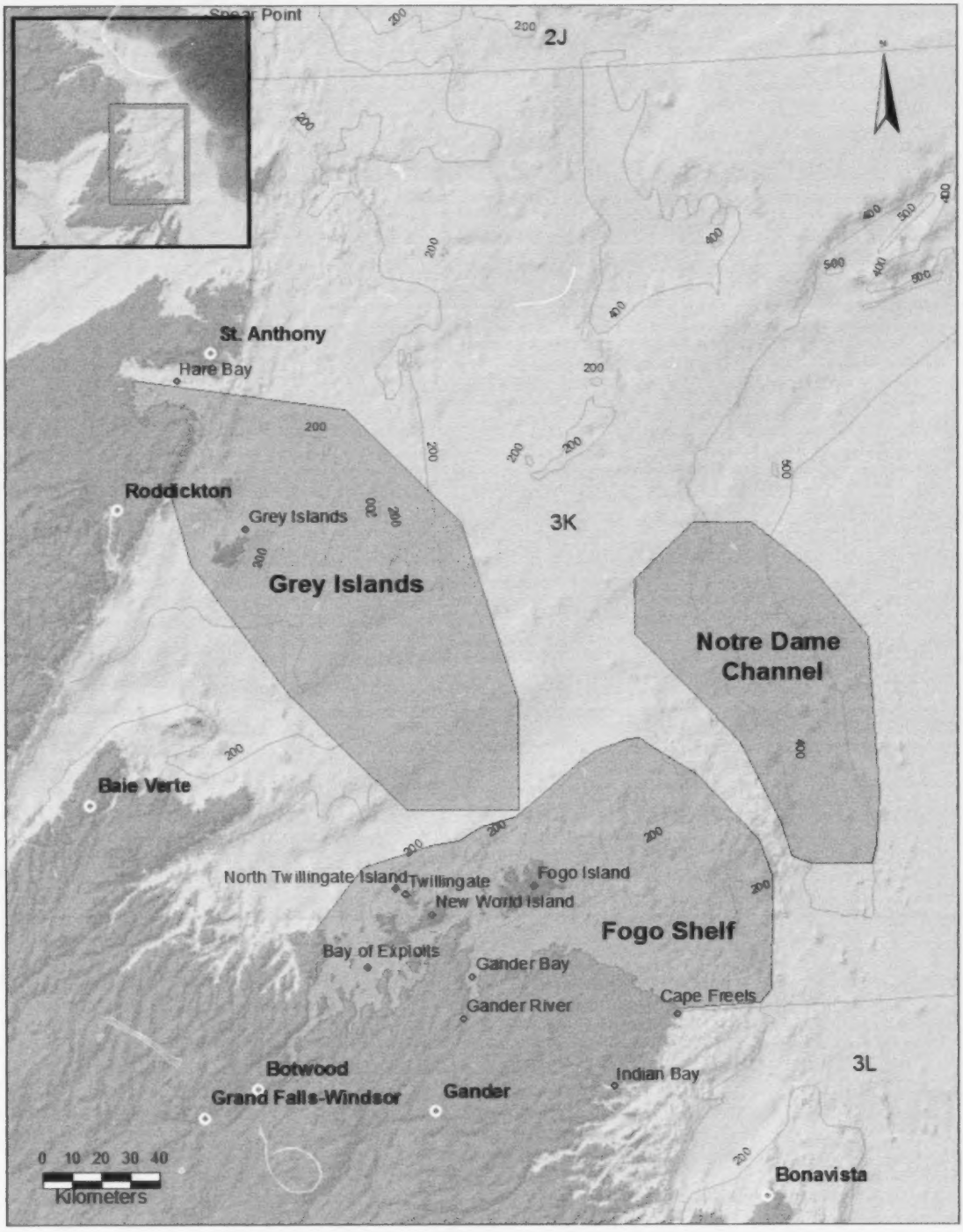

Figure 12: Expanded view of Grey Islands, Fogo Shelf and Notre Dame Channel EBSAs.

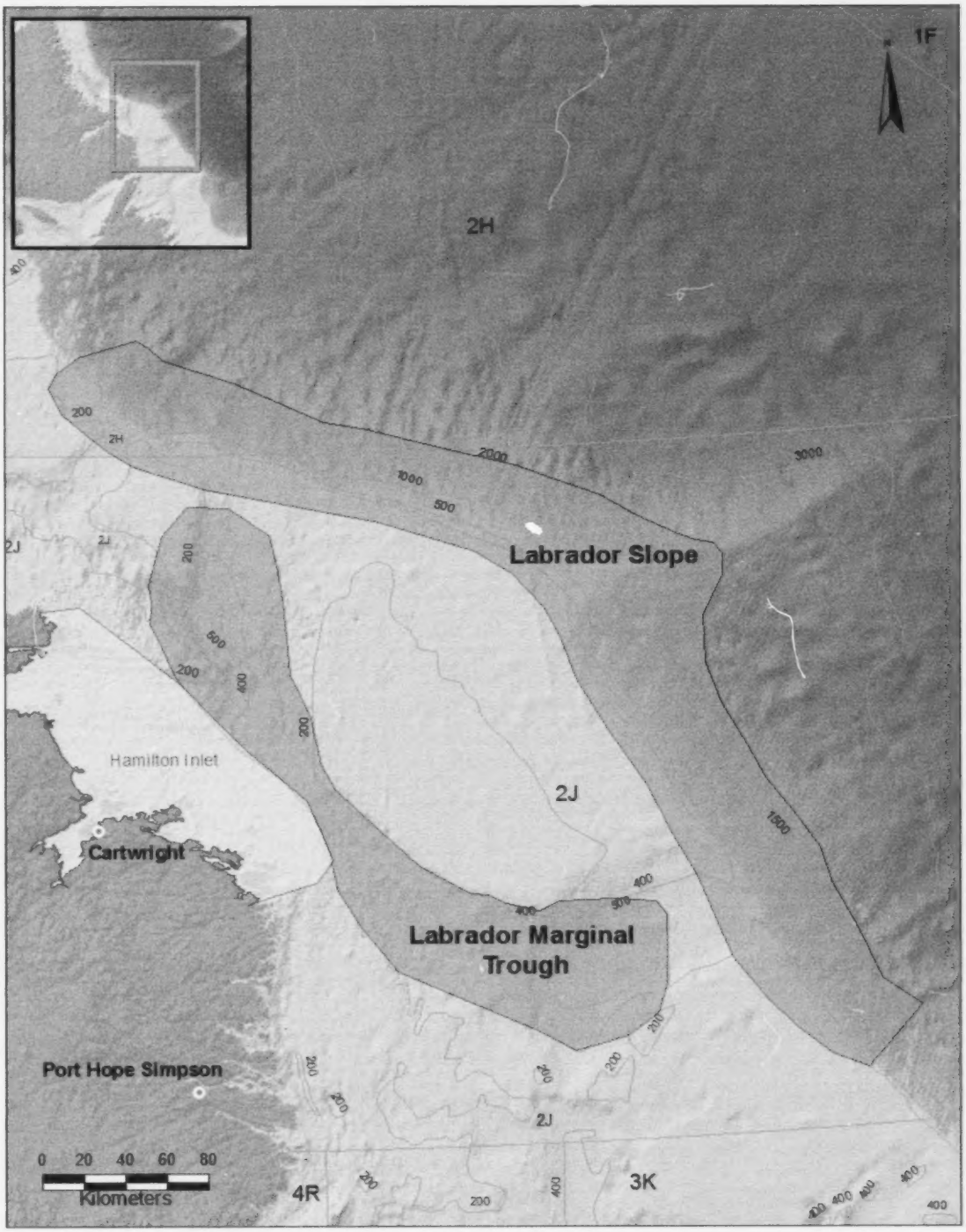

Figure 13: Expanded view of Labrador Slope and Labrador Marginal Trough EBSAs.

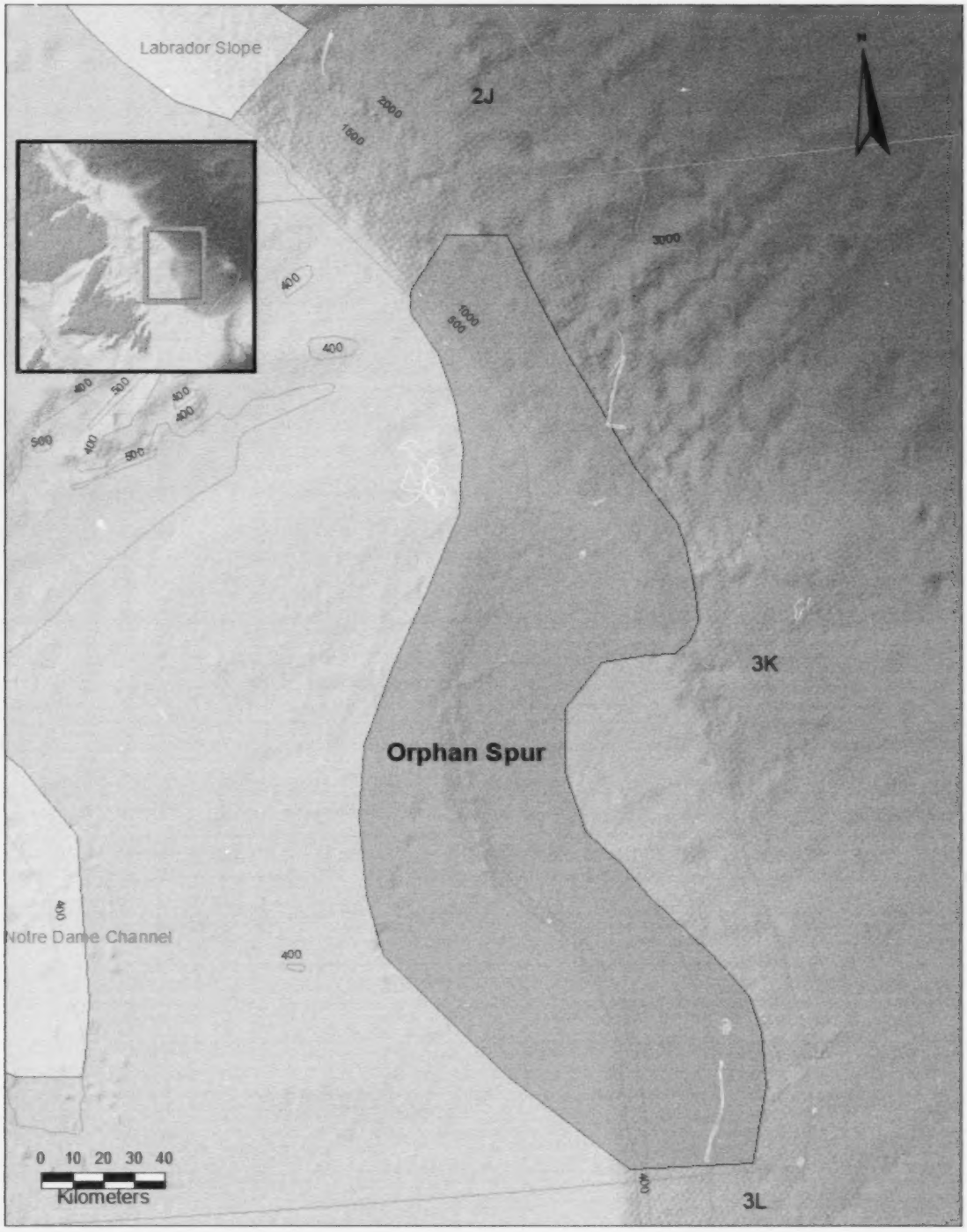

Figure 14: Expanded view of Orphan Spur EBSA.

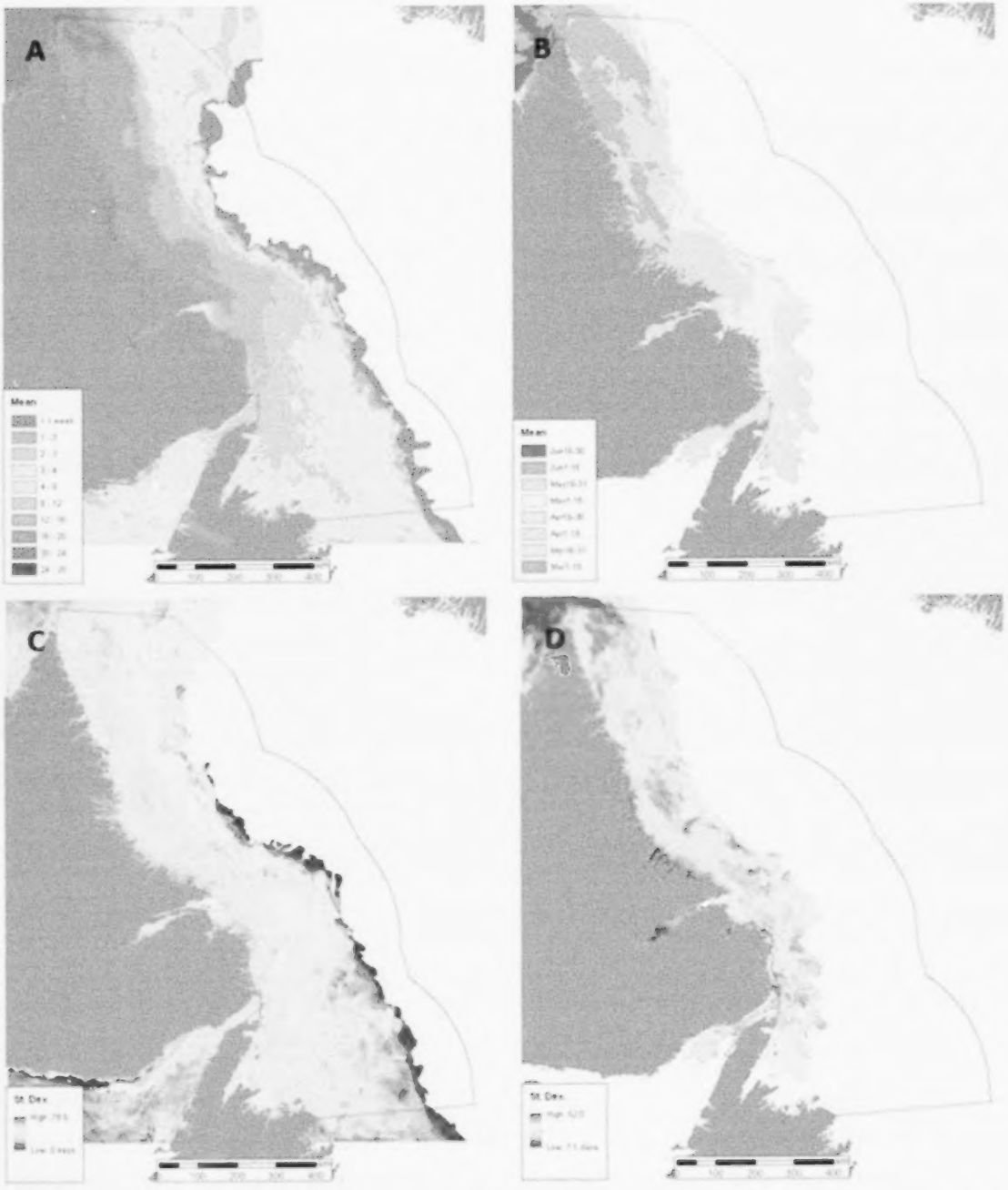

Figure 15: Duration of pack ice cover (A) and date of pack ice retreat (B) for 2002-2011 and corresponding maps indicating standard deviation for each variable (C and D respectively). These variables were calculated for only those weeks when data were present for the entire 10-year period.

APPENDIX A – LIST OF ACRONYMS

Acronym	Definition
CBD	Convention on Biological Diversity
CCRI	Community-Based Coastal Resource Inventory
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSAS	Canadian Science Advisory Secretariat
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
EBSA	Ecologically and Biologically Significant Area
EEZ	Exclusive Economic Zone
EHB	Eastern Hudson Bay
FPT	First Passage Time
GIS	Geographic Information System
IWC	International Whaling Commission
LOMA	Large Ocean Management Area
NAFO	Northwest Atlantic Fisheries Organization
NL	Newfoundland and Labrador
MPA	Marine Protected Area
PCA	Principle Components Analysis
RV	Research Vessel
SARA	*Species at Risk Act*
TEK	Traditional Ecological Knowledge

APPENDIX B – APPLICATION OF EBSA CRITERIA

EBSA Criterion	Application	Examples
Uniqueness	• "Uniqueness" was applied if there were only one or two occurrences of a particular feature in the study area. • In exceptional circumstances features that occurred more than twice were still considered unique as long as they occurred almost exclusively in one area. • "Uniqueness" was not applied to areas that were identified as migratory areas. • "Uniqueness" was not applied to spawning and juvenile data as the data were limited.	Piscivores were found all along the slope edge during the Engel period but the majority of these areas were contained within the Labrador Slope EBSA, so that area was considered unique for that reason.
Aggregation	• "Aggregation" was applied to all DFO RV survey data (corals & sponges and fish), salmonids data, capelin spawning beaches, marine mammals data, and all seabird and waterfowl data. • "Aggregation" was applied to all areas where rare or endangered species were found. For a list of rare or endangered species, see Appendix D.	-
Fitness Consequences	• "Fitness consequences" was applied to all feeding (except, see below), overwintering and spawning areas, as well as areas where juveniles and bird colonies were found. • "Fitness consequences" was not applied to feeding areas of wide ranging species (e.g. harp seals, cetaceans). Such species can adjust their feeding areas should food become limited in a certain area. • "Fitness consequences" was applied to all areas where rare or endangered species were found. • "Fitness consequences" was not applied to areas that were identified as migratory areas.	-

APPENDIX C – RARE OR ENDANGERED SPECIES

Common Name	Scientific Name	Population	COSEWIC Status	SARA status
Atlantic Wolffish	*Anarhichas lupus*	-	Special Concern	Special Concern
Barndoor Skate*	*Dipturus laevis*	-	Not at Risk	Not Assessed
Northern Wolffish	*Anarhichas denticulatus*	-	Threatened	Threatened
Roundnose Grenadier	*Coryphaenoides rupestris*	-	Endangered	No Status
Smooth Skate*	*Malacoraja senta*	Funk Island Deep population	Endangered	No Status
Spotted Wolffish	*Anarhichas minor*	-	Threatened	Threatened
Thorny Skate*	*Amblyraja radiata*	-	Special Concern	No Status
Beluga Whale	*Delphinapterus leucas*	Eastern Hudson Bay population	Endangered	No Status
Barrow's Goldeneye	*Bucephala islandica*	Eastern Population	Special Concern	Special Concern
Ivory Gull	*Pagophila eburnea*	-	Endangered	Endangered
Harlequin Duck	*Histrionicus histrionicus*	Eastern Population	Special Concern	Special Concern

*All species of Skates, including species that have not been assessed by COSEWIC or SARA, were grouped in one data layer based on poor taxonomic identification during the survey period. See Ollerhead et al. 2017 for more information.

APPENDIX D – COMMON AND SCIENTIFIC SPECIES NAMES

Corals and Sponges

Common Name	Scientific Name
Black Corals*	Antipatharia
Large Gorgonians*	Gorgonacea
Sea Pens*	Pennatulacea
Small Gorgonians*	Gorgonacea
Soft Corals*	Alcyonacea
Sponges*	Porifera
Stony Cup Corals*	Scleractinia

Fish

Common Name	Scientific Name
American Plaice	*Hippoglossoides platessoides*
Arctic Charr	*Salvelinus alpinus*
Atlantic Cod	*Gadus morhua*
Atlantic Salmon	*Salmo salar*
Atlantic Wolffish	*Anarhichas lupus*
Brook Trout	*Salvelinus fontinalis*
Capelin	*Mallotus villosus*
Snow Crab	*Chionoecetes opilio*
Greenland Halibut	*Reinhardtius hippoglossoides*
Large Benthivores*	-
Medium Benthivores*	-
Northern Wolffish	*Anarhichas denticulatus*
Piscivores*	-
PlankPiscivores*	-
Planktivores*	-
Redfish	*Sebastes* spp.
Rock Cod	-
Roundnose Grenadier	*Macrourus berglax*
Salmon	*Salmo salar*
Shrimp	*Pandalus borealis*
Skates*	*Raja spp.*
Small Benthivores*	-
Spotted Wolffish	*Anarhichas minor*
Witch Flounder	*Glyptocephalus synoglossus*

Waterfowl

Common Name	Scientific Name
Barrow's Goldeneye	*Bucephala islandica*
Bay Ducks*	*Aythya spp.*
Common Eider	*Somateria mollissima*
Dabbling Ducks*	*Anas* spp.
Geese*	Anserini tribe (Anatidae family)
Harlequin Duck	*Histrionicus histrionicus*
Sea Ducks*	Merginae subfamily

Seabirds

Common Name	Scientific Name
Atlantic Puffin	*Fratercula arctica*
Black Guillemot	*Cepphus grille*
Black-legged Kittiwake	*Rissa tridactyla*
Common Murre	*Uria aalge*
Cory's Shearwater	*Calonectris diomedea*
Dovekie	*Alle alle*
Glaucous Gull	*Larus hyperboreus*
Great Black-backed Gull	*Larus marinus*
Greater Shearwater	*Puffinus gravis*
Herring Gull	*Larus argentatus*
Ivory Gull	*Pagophila eburnea*
Murres*	*Uria* spp.
Northern Fulmar	*Fulmarus glacialis*
Northern Gannet	*Morus bassanus*
Phalaropes*	*Phalaropus spp.*
Razorbill	*Alca torda*
Skuas and Jaegers*	Stercorarius family
Sooty Shearwater	*Puffinus griseus*
Storm Petrels*	Hydrobatidae family
Terns*	Sternidae family
Thick-billed Murre	*Uria lomvia*

Marine Mammals

Common Name	Scientific Name
Beluga Whale	*Delphinapterus leucas*
Cetaceans*	Cetacea
Harp Seal	*Phoca groenlandica*
Hooded Seal	*Cystophora cristata*
Northern Bottlenose Whale	*Hyperoodon ampullatus*
Polar Bear	*Ursus maritimus*
Ringed Seal	*Pusa hispida*
Sperm Whale	*Physeter macrocephalus*

*See Ollerhead et al. 2017 for a list of species in this group.

APPENDIX E – DATA LAYERS FOUND WITHIN EACH EBSA

Offshore data descriptors:

- Edge = a polygon from a particular data layer is generally found outside the boundary of the EBSA but a relatively small portion of it extends inside the boundary (i.e. on the edge).
- Insignificant = species found in a very small area (less than 5%) within the EBSA
- Minor = species found in a few small areas or in part of one moderately sized area (more than 5% but less than 30% of the EBSA)
- Moderate = species found in several small areas or more than one moderately sized area within the EBSA (at least 30% but less than 70% of the EBSA)
- Significant = species found throughout a large portion (greater than 70% but not the entire EBSA) of the EBSA
- Whole = species found throughout the entire EBSA
- Partial = part of a polygon from a particular data layer found within the boundary of the EBSA, but part of the polygon extends outside the EBSA boundary

Coastal EBSAs

Nain (2H)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Capelin spawning beach	minor	1 of 30	Glaucous Gull colonies	moderate	4 of 13 (1 partial)
Arctic Charr	whole	1 of 4	Herring Gull pelagic area	minor	1 of 9
Black Guillemot Summer 2006	moderate	3 of 7	Murres pelagic area	minor	1 of 20 partial
Common Eider Summer 2006	moderate	2 of 8	Harp seal summer feeding area	edge	1 of 1 partial
Common Eider Winter 2010	minor	1 of 4	CCRI Goose Grass	minor	
Sea ducks maximum counts	moderate	4 of 21	CCRI Kelp	significant	
Thick-billed Murre colony	edge	1 of 1 partial	CCRI Rockweed	significant	
-	-	-	CCRI Clam	moderate	-
-	-	-	CCRI Giant Scallop	minor	-
-	-	-	CCRI Mussel	moderate	-
-	-	-	CCRI Atlantic Cod	moderate	-
-	-	-	CCRI Arctic Char	significant	-
-	-	-	CCRI Brook Trout	moderate	-
-	-	-	CCRI Herring	insignificant	-
-	-	-	CCRI Salmon	moderate	-
-	-	-	CCRI Seal	whole	-
-	-	-	CCRI Whale	whole	-

Lake Melville (2J)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Sea ducks maximum counts	moderate	2 of 21	Geese maximum counts	minor	1 of 11
-	-	-	CCRI Kelp	moderate	-
-	-	-	CCRI Rockweed	moderate	-
-	-	-	CCRI Seagrass	moderate	-
-	-	-	CCRI Giant Scallop	insignificant	-
-	-	-	CCRI Mussel	minor	-
-	-	-	CCRI Sea Urchin	minor	-
-	-	-	CCRI Toad Crab	insignificant	-
-	-	-	CCRI Whelk	insignificant	-
-	-	-	CCRI Atlantic Cod	minor	-
-	-	-	CCRI Brook Trout	moderate	-
-	-	-	CCRI Greenland Cod	minor	-
-	-	-	CCRI Arctic Char	minor	-
-	-	-	CCRI Atlantic Salmon/Salmon	minor	-
-	-	-	CCRI Smelt	minor	-
-	-	-	CCRI Seal	whole	-
-	-	-	CCRI Whale	minor	-

Gilbert Bay (2J)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
-	-	-	Capelin spawning beach	minor	1 of 30
-	-	-	Soft corals	moderate	1 of 13 partial
-	-	-	Greater Shearwater pelagic area	edge	1 of 28
-	-	-	Sooty Shearwater pelagic area	edge	1 of 20
-	-	-	Thick-billed Murre Spring KHR	whole	-
-	-	-	CCRI Clam	insignificant	-
-	-	-	CCRI Giant scallop	significant	-
-	-	-	CCRI Mussel	minor	-
-	-	-	CCRI Sea urchin	minor	-
-	-	-	CCRI Snow crab	moderate	-
-	-	-	CCRI Squid	minor	-
-	-	-	CCRI Toad crab	minor	-
-	-	-	CCRI Whelk	moderate	-
-	-	-	CCRI Atlantic cod	significant	-
-	-	-	CCRI Lumpfish	minor	-

Coastal and Offshore EBSAs

Northern Labrador (2G)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Arctic Charr highly productive area	moderate	1 of 4	Black Guillemot Summer 2006	minor	1 of 7
Harlequin Ducks maximum counts	moderate	2 of 4	Common Eider Winter 2010	moderate	2 of 4
Barrow's Goldeneye maximum counts	minor	1 of 1	Sea ducks maximum counts	minor	1 of 21
EHB Belugas migratory area	whole	1 of 1	Glaucous Gull colonies	moderate	4 of 13
-	-	-	Medium benthivores (Engel period)	minor	1 of 14
-	-	-	PlankPiscivores (Engel period)	minor	1 of 2 partial
-	-	-	Juvenile Greenland Halibut (Campelen period)	insignificant	1 of 12
-	-	-	Black-legged Kittiwake pelagic areas	minor	3 of 34 partials
-	-	-	Murres pelagic areas	moderate	2 of 20
-	-	-	Northern Fulmar pelagic areas	moderate	3 of 27
-	-	-	Skuas and Jaegers pelagic areas	moderate	2 of 38
-	-	-	Herring Gull pelagic area	insignificant	1 of 9

Hamilton Inlet (2H)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Capelin spawning beaches	minor	2 beaches	Common Eider Summer 2006	moderate	4 of 8
Salmon (area of high total returns based on counting fence data)	minor	1 of 3	Dabbling ducks maximum counts	moderate	9 of 11
Salmon (high density based on summer drift net data)	moderate	1 of 1	Geese maximum counts	moderate	4 of 11
Atlantic Puffin colonies	minor	2 of 3	Harlequin Duck maximum counts	minor	1 of 4
Razorbill colonies	moderate	4 of 4	Sea ducks maximum counts	minor	3 of 21
-	-	-	Greater Black Backed Gull colonies	moderate	4 of 19
-	-	-	Herring Gull colony	minor	1 of 5
-	-	-	Northern Fulmar colony	insignificant	1 of 2
-	-	-	Medium benthivores (Engel period)	insignificant	1 of 10 partial
-	-	-	Spawning American Plaice (Campelen period)	insignificant	1 of 5 partial
-	-	-	Juvenile Atlantic Cod (Engel period)	moderate	1 of 23 partial
-	-	-	Juvenile Greenland Halibut (Engel period)	insignificant	1 of 20 partial + edge
-	-	-	Atlantic Puffin pelagic area	significant	1 of 10 partial
-	-	-	Black Legged Kittiwake pelagic areas	edge	2 of 34
-	-	-	Dovekie pelagic area	minor	1 of 25
-	-	-	Great Black-backed Gull pelagic area	minor	1 of 12 partial
-	-	-	Herring Gull pelagic area	minor	1 of 9 partial
-	-	-	Murres pelagic area	moderate	1 of 19 partial
-	-	-	Northern Gannet pelagic area	minor	1 of 7 partial
-	-	-	Razorbill pelagic areas	moderate	2 of 5
-	-	-	Skuas and Jaegers pelagic area	minor	1 of 38 partial
-	-	-	Sooty Shearwater pelagic areas	moderate	3 of 20 partials

Hamilton Inlet (2H) – Continued.

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
-	-	-	Thick-billed Murre Spring KHR	whole	-
-	-	-	Cetaceans fall feeding area (based on observer data)	minor	1 of 1 partial
-	-	-	Harp Seal summer feeding	moderate	1 of 1 partial
-	-	-	Harp Seal whelping	minor	1 of 1 partial
-	-	-	CCRI Kelp	moderate	-
-	-	-	CCRI Rockweed	moderate	-
-	-	-	CCRI Seagrass	moderate	-
-	-	-	CCRI Clam	minor	-
-	-	-	CCRI Giant Scallop	minor	-
-	-	-	CCRI Mussel	moderate	-
-	-	-	CCRI Sea Urchin	minor	-
-	-	-	CCRI Shrimp	insignificant	-
-	-	-	CCRI Toad Crab	insignificant	-
-	-	-	CCRI Whelk	minor	-
-	-	-	CCRI Atlantic Cod	moderate	-
-	-	-	CCRI Flounder	insignificant	-
-	-	-	CCRI Lumpfish	insignificant	-
-	-	-	CCRI Skate	insignificant	-
-	-	-	CCRI Arctic Char	moderate	-
-	-	-	CCRI Brook Trout	moderate	-
-	-	-	CCRI Herring	insignificant	-
-	-	-	CCRI Mackerel	insignificant	-
-	-	-	CCRI Salmon/Atlantic Salmon	moderate	-
-	-	-	CCRI Smelt	minor	-
-	-	-	CCRI Dolphin Porpoise	moderate	-
-	-	-	CCRI Seal	moderate	-
-	-	-	CCRI Whale	moderate	-

Grey Islands (3K)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Common Eider Winter 2006	minor	2 of 5	Soft corals	moderate	1 of 13 partial
Harlequin Duck maximum counts	minor	1 of 4	Small gorgonians	minor	1 of 4
Sea Ducks maximum counts	minor	1 of 21	Capelin (Campelen period)	minor	1 of 7 partial
Great Black-backed Gull colonies	moderate	3 of 19	Snow Crab (Campelen period)	minor	1 of 9
Herring Gull colony	insignificant	1 of 5	American Plaice (Engel period)	insignificant	1 of 8 partial
Tern colony	insignificant	1 of 5	Planktivores (Campelen period)	minor	1 of 12 partial
Black-legged Kittiwake pelagic area	significant	1 of 34 partial	Juvenile American Plaice (Campelen period)	minor	2 of 16 (1 partial)
Dovekie pelagic areas	moderate	3 of 25 (1 partial) + edge	Juvenile Greenland Halibut (Campelen period)	minor	1 of 12
Great Black-backed Gull pelagic area	significant	1 of 12 partial	Juvenile Atlantic Cod (Engel period)	minor	1 of 23
Greater Shearwater pelagic area	moderate	1 of 28	Juvenile Greenland Halibut (Engel period)	edge	1 of 20 partial
Herring Gull pelagic area	significant	1 of 9 partial	Hooded Seal males Aug-Feb FPT	moderate	1 of 3
Murres pelagic area	minor	1 of 20	CCRI Kelp	moderate	-
Northern Fulmar pelagic area	moderate	1 of 27 partial	CCRI Giant Scallop	insignificant	-
Northern Gannet pelagic area	moderate	1 of 7	CCRI Lobster	minor	-
Phalaropes pelagic area	minor	1 of 25	CCRI Mussel	insignificant	-

Grey Islands (3K) – Continued.

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Atlantic Puffin pelagic area	moderate	1 of 10	CCRI Rock Crab	minor	-
Skuas and Jaegers pelagic area	minor	1 of 38	CCRI Sea Urchin	minor	-
Sooty Shearwater pelagic area	moderate	1 of 20 partial	CCRI Squid	insignificant	-
Storm petrels pelagic area	minor	1 of 15	CCRI Toad Crab	minor	-
Terns pelagic area	moderate	1 of 13	CCRI Whelk	minor	-
Common Murre Fall KHR	whole		CCRI Atlantic Cod	moderate	-
-	-	-	CCRI Flounder	insignificant	-
-	-	-	CCRI Lumpfish	minor	-
-	-	-	CCRI Winter Flounder	insignificant	-
-	-	-	CCRI Arctic Char	insignificant	-
-	-	-	CCRI Brook Trout	insignificant	-
-	-	-	CCRI Brown Trout	insignificant	-
-	-	-	CCRI Eel	insignificant	-
-	-	-	CCRI Herring	minor	-
-	-	-	CCRI Mackerel	minor	-
-	-	-	CCRI Salmon	minor	-
-	-	-	CCRI Smelt	insignificant	-
-	-	-	CCRI Dolphin Porpoise	minor	-
-	-	-	CCRI Polar Bear	insignificant	-
-	-	-	CCRI Seal	minor	-
-	-	-	CCRI Whale	minor	-

Fogo Shelf (3K)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Capelin spawning areas	moderate	7 beaches & 8 demersal sites	Capelin (Campelen period)	edge	1 of 7
Salmon (area of high total returns based on counting fence data)	moderate	2 of 3	Small benthivores (Campelen period)	minor	1 of 16
Common Eider Winter 2006	minor	2 of 5	Planktivores (Campelen period)	edge	1 of 12
Sea Ducks maximum counts	moderate	6 of 21 (1 partial)	Juvenile Atlantic Cod (Campelen period)	moderate	1 of 8
Atlantic Puffin colony	minor	1 of 3	Juvenile Greenland Halibut (Campelen period)	insignificant	1 of 12 partial
Common Murre colony	minor	1 of 1	Juvenile American Plaice (Engel period)	minor	1 of 13 partial
Great Black-backed Gull colonies	moderate	6 of 19	Spawning American Plaice (Engel period)	edge	1 of 1
Herring Gull colonies	minor	3 of 5	Juvenile Atlantic Cod (Engel period)	minor	1 of 23 partial
Northern Fulmar colony	minor	1 of 2	Spawning Atlantic Cod (Engel period)	minor	1 of 9
Northern Gannet colony	insignificant	1 of 1	Juvenile Greenland Halibut (Engel period)	minor	1 of 20 + edge
Tern colonies	minor	3 of 5	Northern Fulmar pelagic area	edge	1 of 27
Atlantic Puffin pelagic areas	minor	3 of 10 partials	Harp Seal summer feeding	edge	-
Great Black-backed Gull pelagic areas	minor	2 of 12 (1 partial)	Hooded Seal males Aug-Feb (FPT)	moderate	-
Greater Shearwater pelagic area	minor	1 of 28	CCRI Eelgrass	minor	-
Herring Gull pelagic area	insignificant	1 of 9 partial	CCRI Irish Moss	minor	-
Murres pelagic area	moderate	1 of 20 partial	CCRI Kelp	moderate	-
Northern Gannet pelagic area	moderate	1 of 7 partial	CCRI Rockweed	moderate	-
Terns pelagic area	minor	1 of 12	CCRI Clam	minor	-
Common Murre Fall KHR	significant	-	CCRI Giant Scallop	minor	-

Fogo Shelf (3K) – Continued.

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Thick-billed Murre Fall KHR	moderate	-	CCRI Lobster	moderate	-
Cetaceans feeding area (based on survey data)	moderate	-	CCRI Mussel	moderate	-
-	-	-	CCRI Rock Crab	moderate	-
-	-	-	CCRI Sea Urchin	moderate	-
-	-	-	CCRI Snail	minor	-
-	-	-	CCRI Snow Crab	moderate	-
-	-	-	CCRI Soft Shell Clam	insignificant	-
-	-	-	CCRI Squid	moderate	-
-	-	-	CCRI Toad Crab	moderate	-
-	-	-	CCRI Whelk	insignificant	-
-	-	-	CCRI Brook Trout	insignificant	-
-	-	-	CCRI Eel	insignificant	-
-	-	-	CCRI Herring	minor	-
-	-	-	CCRI Mackerel	moderate	-
-	-	-	CCRI Salmon	minor	-
-	-	-	CCRI Smelt	insignificant	-
-	-	-	CCRI American Plaice	moderate	-
-	-	-	CCRI Atlantic Cod	significant	-
-	-	-	CCRI Flounder	minor	-
-	-	-	CCRI Lumpfish	moderate	-
-	-	-	CCRI Redfish	minor	-
-	-	-	CCRI Skate	moderate	-
-	-	-	CCRI Turbot	minor	-
-	-	-	CCRI Winter Flounder	minor	-
-	-	-	CCRI Witch Flounder	insignificant	-
-	-	-	CCRI Dolphin Porpoise	moderate	-
-	-	-	CCRI Seal	moderate	-
-	-	-	CCRI Whale	significant	-

Offshore EBSAs

Outer Shelf Saglek Bank (2G)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Sea pens	minor	1 of 6	Roundnose Grenadier (Engel period)	minor	1 of 6
Large gorgonians	moderate	1 of 1	Hooded Seal males Aug-Feb (FPT)	edge	
Sponges	moderate	1 of 2	Juvenile Atlantic Cod (Engel period)	edge	1 of 23
Black-legged Kittiwakes pelagic areas	moderate	3 of 34	-	-	-
Dovekie pelagic area	minor	1 of 25	-	-	-
Greater Shearwater pelagic area	moderate	1 of 28	-	-	-
Ivory Gull pelagic areas	significant	2 of 8	-	-	-
Murre pelagic areas	moderate	4 of 20	-	-	-
Northern Fulmar pelagic areas	minor	2 of 27	-	-	-
Phalaropes pelagic areas	moderate	4 of 25 (1 partial)	-	-	-
Skuas and Jaegers pelagic areas	minor	2 of 38	-	-	-
Terns pelagic area	minor	1 of 13	-	-	-
Storm Petrels pelagic area	minor	1 of 15	-	-	-
Thick-billed Murre Early Winter KHR	significant	-	-	-	-
Thick-billed Murre Late Winter KHR	moderate	-	-	-	-
Thick-billed Murre Spring KHR	significant	-	-	-	-
Cetaceans feeding/migration area (based on observer data)	moderate	-	-	-	-
Harp Seals summer feeding	moderate	-	-	-	-
Hooded Seal females Aug-Feb (FPT)	moderate	-	-	-	-

Outer Shelf Nain Bank (2H)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Black corals	minor	1 of 4	Juvenile American Plaice (Campelen period)	moderate	1 of 16 partial
Sea pens	minor	1 of 6	Harp Seal summer feeding area	significant	1 of 1 partial
Soft corals	minor	1 of 13 partial	PlankPiscivores (Campelen period)	edge	1 of 8
Black corals	moderate	1 of 4	-	-	-
Stony cup corals	moderate	1 of 3	-	-	-
Medium Benthivores (Campelen period)	minor	1 of 10	-	-	-
Small Benthivores (Campelen period)	moderate	1 of 16	-	-	-
Planktivores (Campelen period)	moderate	1 of 12	-	-	-
Black-legged Kittiwake pelagic area	moderate	1 of 34	-	-	-
Dovekie pelagic areas	significant	3 of 25	-	-	-
Ivory Gull pelagic area	significant	1 of 8	-	-	-
Phalaropes pelagic areas	moderate	3 of 25 (2 partials)	-	-	-
Skuas and Jaegers pelagic area	moderate	1 of 38	-	-	-
Terns pelagic area	minor	1 of 13	-	-	-
Thick-billed Murre Spring KHR	significant		-	-	-
Hooded Seal Females Apr-Jun (FPT)	moderate	1 of 1 partial	-	-	-
Hooded Seal Females Aug-Feb (FPT)	moderate	1 of 7 partial	-	-	-
Hooded Seal Juveniles Aug-Feb (FPT)	minor	1 of 5 partial	-	-	-

Hopedale Saddle (2H)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
EHB Belugas overwintering area	significant	1 of 1	Sea pens	moderate	2 of 6
-	-	-	Small gorgonians	minor	1 of 4
-	-	-	Soft corals	minor	1 of 13 partial
-	-	-	Atlantic Wolffish (Campelen period)	minor	2 of 8
-	-	-	Roundnose Grenadier (Campelen period)	minor	1 of 4 partial
-	-	-	Skates (Campelen period)	moderate	1 of 9
-	-	-	Roundnose Grenadier (Engel period)	minor	2 of 6
-	-	-	Spotted Wolffish (Engel period)	insignificant	1 of 10 partial
-	-	-	Greenland Halibut (Campelen period)	moderate	2 of 11
-	-	-	Redfish (Campelen period)	insignificant	1 of 4
-	-	-	Shrimp (Campelen period)	minor	2 of 11
-	-	-	Medium benthivores (Campelen period)	insignificant	1 of 10 + edge
-	-	-	Small benthivores (Campelen period)	moderate	4 of 16
-	-	-	Planktivores (Campelen period)	minor	1 of 12 partial
-	-	-	Piscivores (Campelen period)	insignificant	1 of 14 partial
-	-	-	PlankPiscivores (Campelen period)	minor	1 of 8
-	-	-	Juvenile American Plaice (Campelen period)	minor	1 of 16
-	-	-	Juvenile Greenland Halibut (Campelen period)	moderate	2 of 12
-	-	-	Juvenile Greenland Halibut (Engel period)	significant	2 of 20
-	-	-	Atlantic Puffin pelagic area	minor	1 of 10 partial
-	-	-	Black-legged Kittiwake pelagic areas	minor	2 of 34 (1 partial)
-	-	-	Dovekie pelagic areas	moderate	3 of 25 (2 partials)
-	-	-	Greater Shearwater pelagic areas	minor	2 of 28 partials
-	-	-	Ivory Gull pelagic area	minor	1 of 8

Hopedale Saddle (2H) – Continued.

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
-	-	-	Murres pelagic areas	moderate	2 of 20 partials
-	-	-	Northern Fulmar pelagic areas	insignificant	1 of 27 partial + edge
-	-	-	Phalaropes pelagic areas	insignificant	1 of 25 + edge
-	-	-	Razorbill pelagic area	insignificant	1 of 6
-	-	-	Skuas and Jaegers pelagic areas	edges	2 of 38
-	-	-	Sooty Shearwaters pelagic areas	moderate	2 of 20 (1 partial)
-	-	-	Terns pelagic areas	minor	1 of 14 partial + edge
-	-	-	Thick-billed Murre Spring KHR	moderate	-
-	-	-	Harp Seals summer feeding	whole	-
-	-	-	Hooded Seal Females Aug-Feb (FPT)	moderate	-
-	-	-	Hooded Seal Juveniles Aug-Feb (FPT)	minor	-
-	-	-	Sea ducks maximum counts	insignificant	1 of 21
-	-	-	Thick-billed Murre colony	minor	1 of 1
-	-	-	Glaucous Gull colony	minor	1 of 13
-	-	-	CCRI Atlantic Cod	minor	-
-	-	-	CCRI Salmon	insignificant	-
-	-	-	CCRI Arctic Char	insignificant	-
-	-	-	CCRI Kelp	minor	-
-	-	-	CCRI Rockweed	insignificant	-
-	-	-	CCRI Seal	moderate	-
-	-	-	CCRI Whale	moderate	-

Labrador Slope (2HJ)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Soft corals	minor	3 of 13 (2 partials)	Spotted Wolffish (Engel period)	edge	1 of 10
Black corals	insignificant	1 of 4	American Plaice (Engel period)	edge	1 of 8 partial
Sponges	moderate	1 of 2	Juvenile American Plaice (Campelen period)	insignificant	1 of 16
Atlantic Wolffish (Campelen period)	moderate	3 of 8 (2 partials)	Juvenile Atlantic Cod (Campelen period)	minor	3 of 8 (2 partials)
Northern Wolffish (Campelen period)	moderate	3 of 8	Juvenile Greenland Halibut (Campelen period)	insignificant	1 of 12 partial
Roundnose Grenadier (Campelen period)	minor	2 of 4	Juvenile Witch Flounder (Campelen period)	minor	2 of 8 partials
Spotted Wolffish (Campelen period)	minor	1 of 4 partial	Juvenile American Plaice (Engel period)	edge	1 of 13
Atlantic Wolffish (Engel period)	minor	2 of 8 partials + edge	Juvenile Atlantic Cod (Engel period)	minor	4 of 23 (3 partials)
Northern Wolffish (Engel period)	moderate	3 of 8 partials	Spawning Atlantic Cod (Engel period)	minor	3 of 10 (1 partial)
Roundnose Grenadier (Engel period)	minor	1 of 6	Juvenile Greenland Halibut (Engel period)	insignificant	1 of 20
Skates (Engel period)	minor	2 of 10 (1 partial)	Juvenile Witch Flounder (Engel period)	minor	2 of 9
-	-	-	Black-legged Kittiwake pelagic areas	moderate	5 of 34 (4 partials)
American Plaice (Campelen period)	minor	1 of 7 partial	Dovekie pelagic areas	minor	2 of 25 partials

Labrador Slope (2HJ)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Atlantic Cod (Campelen period)	insignificant	1 of 2 partial	Great Black-backed Gull pelagic area	minor	1 of 12 partial
Greenland Halibut (Campelen period)	minor	2 of 11	Greater Shearwater pelagic areas	moderate	7 of 28 (3 partials)
Redfish (Campelen period)	minor	1 of 4 partial	Ivory Gull pelagic area	minor	1 of 8 partial
Shrimp (Campelen period)	minor	4 of 11 partials	Murres pelagic areas	minor	4 of 20 (3 partials)
-	-	-	Northern Fulmar pelagic areas	moderate	6 of 27 (4 partials)
Atlantic Cod (Engel period)	minor	2 of 5 partials	Phalaropes pelagic areas	moderate	3 of 25 partials
Greenland Halibut (Engel period)	moderate	5 of 9 (4 partials)	Skuas and Jaegers pelagic areas	moderate	5 of 38 (3 partials)
Redfish (Engel period)	moderate	3 of 8 partials	Sooty Shearwaters pelagic areas	minor	2 of 20 partials + edge
Large benthivores (Campelen period)	moderate	5 of 9 (1 partial)	Terns pelagic areas	minor	2 of 13 (1 partial)
Medium benthivores (Campelen period)	significant	5 of 10 (1 partial)	Thick-billed Murre Fall KHR	moderate	-
Small benthivores (Campelen period)	moderate	6 of 16 (1 partial)	Thick-billed Murre Early Winter KHR	moderate	-
Planktivores (Campelen period)	moderate	6 of 12 (4 partial)	Thick-billed Murre Late Winter KHR	minor	-
Piscivores (Campelen period)	significant	6 of 14 (3 partials)	Thick-billed Murre Spring KHR	significant	-
PlankPiscivores (Campelen period)	minor	1 of 8 partial + edge	Cetaceans fall feeding area (based on observer data)	edge	1 of 1 partial
Large benthivores (Engel period)	moderate	3 of 7 partials	Harp Seals summer feeding	minor	1 of 1 partial
Medium benthivores (Engel period)	minor	2 of 10 partials	Hooded Seal females Aug-Feb (FPT)	moderate	4 of 7 partials
Small benthivores (Engel period)	moderate	5 of 9 (4 partials)	Hooded Seal juveniles Aug-Feb (FPT)	moderate	1 of 5 partial
Planktivores (Engel period)	minor	2 of 2	-	-	-
Piscivores (Engel period)	moderate	4 of 6 (1 partial)	-	-	-

Labrador Marginal Trough (2J)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
American Plaice (Campelen period)	minor	2 of 7	Atlantic Wolffish (Campelen period)	edge	2 of 8
Capelin (Campelen period)	insignificant	1 of 7 partial	Spotted Wolffish (Campelen period)	edge	1 of 4 partial
Greenland Halibut (Campelen period)	significant	3 of 11 (2 partials)	Atlantic Wolffish (Engel period)	edge	2 of 8 partials
Shrimp (Campelen period)	moderate	4 of 11 (3 partials)	Northern Wolffish (Engel period)	moderate	2 of 8 partials
Snow Crab (Campelen period)	minor	1 of 9 partial	Spotted Wolffish (Engel period)	moderate	5 of 10 partials
Witch Flounder (Campelen period)	insignificant	1 of 2	Atlantic Cod (Engel period)	edge	1 of 5 partial
American Plaice (Engel period)	minor	1 of 8 partial	Planktivores (Campelen period)	insignificant	1 of 12 partial
Greenland Halibut (Engel period)	significant	2 of 9 (1 partial)	PlankPiscivores (Campelen period)	moderate	2 of 8 partials
Capelin historical acoustic data	minor	1 of 2 partial	Large Benthivores (Engel period)	moderate	1 of 7 partial
Small Benthivores (Campelen period)	minor	2 of 16 (1 partial)	Medium Benthivores (Engel period)	minor	3 of 10 (2 partials)
Cetaceans fall feeding area (based on observer data)	moderate	1 of 1 partial	Small Benthivores (Engel period)	moderate	2 of 9 (1 partial)
Harp Seals summer feeding	moderate	1 of 1 partial	Spawning American Plaice (Campelen period)	edge	1 of 5 partial
Harp Seals whelping	moderate	1 of 1 partial	Juvenile Atlantic Cod (Campelen period)	moderate	1 of 8 partial
-	-	-	Spawning Atlantic Cod (Campelen period)	minor	1 of 1
-	-	-	Juvenile Greenland Halibut (Campelen period)	moderate	4 of 12 (1 partial)
-	-	-	Juvenile American Plaice (Engel period)	minor	2 of 13 partials + edge
-	-	-	Juvenile Atlantic Cod (Engel period)	minor	5 of 23 partials
-	-	-	Spawning Atlantic Cod (Engel period)	minor	2 of 10 (1 partial)
-	-	-	Juvenile Greenland Halibut (Engel period)	moderate	4 of 20 (2 partials)
-	-	-	Atlantic Puffin pelagic area	moderate	1 of 10 partial
-	-	-	Black-legged Kittiwake pelagic area	moderate	1 of 34 + edge
-	-	-	Dovekie pelagic area	edge	1 of 25 partial
-	-	-	Great Black-backed Gull pelagic areas	moderate	2 of 12 (1 partial)
-	-	-	Greater Shearwater pelagic areas	minor	2 of 28 partials
-	-	-	Herring Gull pelagic areas	moderate	2 of 9 (1 partial)
-	-	-	Ivory Gull pelagic area	minor	1 of 8 partial
-	-	-	Murres pelagic area	minor	1 of 20 partial

Labrador Marginal Trough (2J) – Continued.

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
-	-	-	Northern Fulmar pelagic areas	moderate	3 of 27 (2 partials)
-	-	-	Phalaropes pelagic area	edge	1 of 25 partial
-	-	-	Razorbill pelagic area	insignificant	1 of 6
-	-	-	Skuas and Jaegers pelagic areas	minor	4 of 38 partials
-	-	-	Sooty Shearwater pelagic areas	minor	2 of 20 partials
-	-	-	Common Murre Fall KHR	minor	-
-	-	-	Thick-billed Murre Spring KHR	whole	-
-	-	-	Hooded Seal males Aug-Feb (FPT)	minor	1 of 3 partial
-	-	-	Hooded Seal juveniles Aug-Feb (FPT)	moderate	2 of 5 (1 partial)
-	-	-	Hooded Seal females Aug-Feb (FPT)	moderate	1 of 7 partial

Notre Dame Channel (3K)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Skates (Campelen period)	significant	1 of 9	Planktivores (Campelen period)	insignificant	1 of 12 partial
Skates (Engel period)	significant	1 of 10 partial	Juvenile American Plaice (Campelen period)	moderate	3 of 16 (2 partials)
American Plaice (Campelen period)	significant	2 of 7 (1 partial)	Juvenile Greenland Halibut (Campelen period)	significant	1 of 12 partial
Capelin (Campelen period)	moderate	1 of 7 partial	Juvenile Witch Flounder (Campelen period)	significant	1 of 8
Greenland Halibut (Campelen period)	significant	1 of 11	Juvenile American Plaice (Engel period)	moderate	2 of 13 partials
Shrimp (Campelen period)	minor	1 of 11	Spawning American Plaice (Engel period)	minor	1 of 1 partial
Snow Crab (Campelen period)	significant	2 of 9 partials	Juvenile Greenland Halibut (Engel period)	significant	2 of 20 partials
Greenland Halibut (Engel period)	significant	1 of 9 partial	Juvenile Witch Flounder (Engel period)	moderate	1 of 9 partial
Redfish (Engel period)	minor	1 of 8 partial	Atlantic Puffing pelagic area	edge	1 of 10
Witch Flounder (Engel period)	significant	1 of 6 partial	Black-legged Kittiwake pelagic area	moderate	1 of 34 partial
Cetaceans feeding area (based on survey data)	significant		Great Black-backed Gull pelagic area	moderate	1 of 12 partial
IWC historical spring/summer data	significant	1 of 1 partial	Herring Gull pelagic area	insignificant	1 of 9 partial
-	-	-	Murres pelagic areas	moderate	2 of 20 partials
-	-	-	Northern Fulmar pelagic area	minor	1 of 27
-	-	-	Northern Gannet pelagic area	minor	1 of 7 partial
-	-	-	Phalaropes pelagic area	minor	1 of 25 partial
-	-	-	Razorbill pelagic area	edge	1 of 6
-	-	-	Skuas and Jaegers pelagic area	minor	1 of 38 partial
-	-	-	Sooty Shearwater pelagic area	moderate	1 of 20 partial + edge
-	-	-	Storm Petrels pelagic area	moderate	1 of 15 partial
-	-	-	Common Murre Fall KHR	edge	-
-	-	-	Thick-billed Murre Fall KHR	whole	-
-	-	-	Harp Seals Winter Feeding	whole	1 of 1 partial

Orphan Spur (3K)

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Black Corals	minor	2 of 4	Atlantic Wolffish (Engel period)	edge	1 of 8
Sea Pens	moderate	2 of 6	Shrimp (Campelen period)	edge	1 of 11
Small Gorgonians	moderate	2 of 4	Juvenile American Plaice (Campelen period)	minor	1 of 16 + 2 edges
Soft Corals	moderate	4 of 13	Spawning American Plaice (Campelen period)	moderate	4 of 5 (2 partials)
Stony Cup Corals	minor	1 of 3	Juvenile Witch Flounder (Campelen period)	moderate	4 of 8 (2 partials)
Atlantic Wolffish (Campelen period)	moderate	2 of 8 partials	Juvenile Atlantic Cod (Engel period)	moderate	3 of 23 (2 partials)
Northern Wolffish (Campelen period)	significant	4 of 8 (1 partial)	Spawning Atlantic Cod (Engel period)	moderate	2 of 10 partials
Roundnose Grenadier (Campelen period)	minor	1 of 4 partial	Juvenile Greenland Halibut (Engel period)	minor	1 of 20 partial
Skates (Campelen period)	significant	5 of 9 (3 partials)	Juvenile Witch Flounder (Engel period)	minor	2 of 9
Spotted Wolffish (Campelen period)	moderate	2 of 4 (1 partial)	Black-legged Kittiwake pelagic areas	moderate	3 of 34 (1 partial)
Northern Wolffish (Engel period)	minor	1 of 8	Dovekie pelagic area	moderate	1 of 25 partial
Roundnose Grenadier (Engel period)	minor	1 of 6	Great Black-backed Gull pelagic area	insignificant	1 of 12
Skates (Engel period)	insignificant	1 of 10 partial	Greater Shearwater pelagic areas	moderate	3 of 28 (2 partials) + edge
Spotted Wolffish (Engel period)	moderate	2 of 10 partials	Murres pelagic area	minor	1 of 20 partial
American Plaice (Campelen period)	moderate	2 of 7 partials	Northern Fulmar pelagic areas	moderate	3 of 27 (1 partial)
Atlantic Cod (Campelen period)	moderate	1 of 2 partial	Skuas and Jaegers pelagic areas	moderate	2 of 38 (1 partial) + 2 edges
Redfish (Campelen period)	significant	2 of 4 (1 partial)	Sooty Shearwater pelagic area	moderate	1 of 20
Witch Flounder (Campelen period)	significant	1 of 2 partial	Storm Petrels pelagic areas	moderate	5 of 15 (4 partials)
Atlantic Cod (Engel period)	moderate	2 of 5 partials	Common Murre Fall KHR	significant	-
Redfish (Engel period)	moderate	2 of 8 partials + 2 edges	Common Murre Early Winter KHR	significant	-
Witch Flounder (Engel period)	minor	1 of 6	Common Murre Late Winter KHR	moderate	-
Large benthivores (Campelen period)	moderate	2 of 9 partials + edge	Thick-billed Murre Fall KHR	significant	-
Medium benthivores (Campelen period)	significant	2 of 10 (1 partials) + edge	Thick-billed Murre Early Winter KHR	significant	-

Orphan Spur (3K) – Continued.

Key data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA compared to # in entire study area	Other data layers within the EBSA	Description of data relative to EBSA size	# of polygons in this EBSA/# in entire study area
Small benthivores (Campelen period)	significant	1 of 16 partial	Thick-billed Murre Late Winter KHR	moderate	-
Piscivores (Campelen period)	moderate	4 of 14 + 2 edges	Harp Seal winter feeding area	edge	1 of 1 partial
Large benthivores (Engel period)	moderate	3 of 7 (1 partial)	Hooded Seal females Aug-Feb (FPT)	moderate	2 of 7 (1 partial)
Medium benthivores (Engel period)	minor	1 of 10	-	-	-
Small benthivores (Engel period)	significant	1 of 9 partial	-	-	-
Piscivores (Engel period)	moderate	1 of 6	-	-	-

APPENDIX F – IMPORTANT BIRD AREAS FOUND WITHIN EACH EBSA

List of IBAs found within EBSAs identified in the NL Shelves Bioregion. Information provided by Bird Studies Canada. Season: BR - breeding; S - summer, non-breeding typically; FM - fall migration; WI - wintering; SM - spring migration; R - year round (resident); O - other. IBA Criteria: N - national; C - continental; G - global. Species at Risk Status: SC - Special Concern. Note: species shown in bold indicate that their population level (as estimated by the maximum number) exceeds at least one of the IBA thresholds (national, continental or global). See Figures F1a and F1b below Table for map of the IBAs contained in this list.

IBA site name	Surrounding EBSA	Species (Population/Species at Risk Status)	Season	IBA criteria	Comments
Gannet Islands	Hamilton Inlet	**Atlantic Puffin**	BR	G	Maximum count equaled approximately 13% of the eastern North America population.
-	-	Black Guillemot	BR	-	-
-	-	Black-legged Kittiwake (W. Atlantic)	BR	-	-
-	-	**Colonial Waterbirds/Seabirds**	BR	G	The Gannet Islands support breeding populations of all the auk species occurring in eastern Canada, including the most southerly colony of a substantial number of Thick-billed Murres.
-	-	**Common Murre** (Atlantic)	BR	G	Maximum count equaled approximately 11% of the eastern North America population.
-	-	Great Black-backed Gull	BR	-	-
-	-	**Harlequin Duck** (Eastern/SC)	SU	C	-
-	-	Leach's Storm-Petrel (W. Atlantic)	BR	-	-
-	-	Northern Fulmar	BR	-	-
-	-	**Razorbill**	BR	G	The largest Razorbill colony in eastern North America (maximum count equaled over 14% of the eastern North America population).
-	-	Thick-billed Murre (Atlantic)	BR	-	-
Seven Islands Bay	Northern Labrador	Common Eider (Atlantic)	BR	-	-
-	-	**Harlequin Duck** (Eastern/SC)	SU	C	Maximum count represents as much as 22% of the estimated eastern North American population, and is the largest concentration of Harlequin Ducks ever recorded in Labrador.

IBA site name	Surrounding EBSA	Species (Population/Species at Risk Status)	Season	IBA criteria	Comments
Offshore Islands Southeast of Nain	Hopedale Saddle	**Atlantic Puffin**	BR	G	Over 3% of the estimated North American population.
-	-	Black Guillemot	BR	-	-
-	-	**Colonial Waterbirds/Seabirds**	BR	G	No recent seabird surveys have been completed.
-	-	Common Murre (Atlantic)	BR	-	-
-	-	**Glaucous Gull**	BR	G	1.4% of the estimated North American population, although the population is poorly known.
-	-	**Razorbill**	BR	G	About 2.2% of the estimated North American population.
-	-	Thick-billed Murre (Atlantic)	BR	-	-
Nain Coastline	Nain Area	**Harlequin Duck** (Eastern/SC)	SU	C	Pre-moult flock. Moulting sites for this species have not yet been located along this stretch of coastline.
-	-	Peregrine Falcon (anatum/SC)	BR	-	Newfoundland Wildlife Division has recorded five breeding territories (four of which were active in 1998). The nesting density may exceed 1% of the estimated *anatum* population.
-	-	**Surf Scoter**	SU	G	Maximum count represents at least 1% of the world's estimated Surf Scoter population.
Goose Brook	Hamilton Inlet	Canada Goose (North Atlantic)	SM	-	-
-	-	**Canada Goose** (North Atlantic)	FM	C	Maximum count represents approximately 5% of the estimated North Atlantic population. Identified Goose Bay as the most important staging area for Canada Geese in Labrador.

IBA site name	Surrounding EBSA	Species (Population/Species at Risk Status)	Season	IBA criteria	Comments
Northeast Groswater Bay	Hamilton Inlet	**Atlantic Puffin**	BR	G	Almost 6% of the estimated North American Atlantic Puffin population.
-	-	Black Guillemot	BR	-	-
-	-	**Colonial Waterbirds/Seabirds**	BR	G	No more recent surveys have been completed.
-	-	Common Murre (Atlantic)	BR	-	Just below 1% of the estimated eastern North American population.
-	-	Great Black-backed Gull	BR	-	-
-	-	Herring Gull	BR	-	-
-	-	Leach's Storm-Petrel (W. Atlantic)	BR	-	-
-	-	**Razorbill**	BR	G	As much as 5% of the estimated North American population.
-	-	Thick-billed Murre (Atlantic)	BR	-	-
South Groswater Bay Coastline	Hamilton Inlet	**Black Scoter** (Northeast)	FM	C	Maximum count represents about 1% of the estimated eastern North American population.
-	-	**Common Eider** (Atlantic)	BR	C	This nesting colony would represent about 1.25% of the estimated breeding population for the *dresseri* subspecies.
-	-	Surf Scoter	SU	-	-
-	-	Waterfowl	BR	-	-

IBA site name	Surrounding EBSA	Species (Population/Species at Risk Status)	Season	IBA criteria	Comments
Bird Island	Hamilton Inlet	**Atlantic Puffin**	BR	G	About 2.2% of the estimated North American population.
-	-	**Colonial Waterbirds/Seabirds**	BR	G	No more recent surveys have been completed.
-	-	Common Murre (Atlantic)	BR	-	-
-	-	Great Black-backed Gull	BR	-	-
-	-	Leach's Storm-Petrel (W. Atlantic)	BR	-	-
-	-	**Razorbill**	BR	G	About 4.1% of the estimated North American population.
-	-	Thick-billed Murre (Atlantic)	BR	-	-
Cape Porcupine	Hamilton Inlet	Scoters	OT	-	All three species (Surf, White-winged, Black) are found in the area, though Surf Scoters make up the vast majority of the birds present.
-	-	**Surf Scoter**	SU	G	Maximum count represents over 1% of the estimated North American Surf Scoter population. Likely staging in their premoulting season.
-	-	**Waterfowl**	SU	N	-
Galvano Island	Northern Labrador	Colonial Waterbirds/Seabirds	BR	-	-
-	-	**Common Eider** (NE Arctic)	BR	C	This represents about 1% of the estimated *borealis* Common Eider population.
-	-	Common Eider (NE Arctic)	SU	-	Incomplete survey.
Tumbledown Dick Islands and Stag Islands	Hamilton Inlet	Common Eider (Atlantic)	SU	-	-
-	-	**Harlequin Duck** (Eastern/SC)	SU	C	This survey represents almost 11% of the estimated eastern North American Harlequin Duck population. 57 near Stag Islands; 105 near Tumbledown Dick Islands.
-	-	Waterfowl	SU	-	-

IBA site name	Surrounding EBSA	Species (Population/Species at Risk Status)	Season	IBA criteria	Comments
The Backway	Lake Melville	Black Scoter (Northeast)	SU	-	-
-	-	**Surf Scoter**	SU	G	Maximum count of this concentration of scoters was the largest ever recorded in eastern Canada, and represented over 3.3% of worlds estimated Surf Scoter population.
-	-	**Waterfowl**	SU	G	-
-	-	White-winged Scoter	SU	-	-
Table Bay	Hamilton Inlet	Colonial Waterbirds/Seabirds	BR	-	-
-	-	**Common Eider** (Atlantic)	BR	C	The nesting population at this site exceeds the combined 1% threshold for both subspecies (*borealis* and *dresseri*).
-	-	Peregrine Falcon (anatum) (SC)	BR	-	-
-	-	Scoters	SU	-	-
Funk Island	Fogo Shelf	Atlantic Puffin	BR	-	-
-	-	Black-legged Kittiwake (W. Atlantic)	BR	-	-
-	-	**Colonial Waterbirds/Seabirds**	BR	G	-
-	-	**Common Murre** (Atlantic)	BR	G	Approximately 4% of the global population and as much as 67% of the eastern North American population is present.
-	-	Great Black-backed Gull	BR	-	-
-	-	Herring Gull	BR	-	-
-	-	Northern Fulmar	BR	-	-
-	-	**Northern Gannet**	BR	G	Represents over 2% of the global population and almost 14% of the North American population.
-	-	Razorbill	BR	-	-
-	-	Thick-billed Murre (Atlantic)	BR	-	-
Fischot Islands	Grey Islands	**Common Eider**	WI	G	Represents as much as 3.5% of the northern (spp. *borealis*) population. It is likely that a small number of the wintering birds are of the Atlantic (*dresseri* ssp.) population as well.
-	-	**Waterfowl**	WI	N	-

IBA site name	Surrounding EBSA	Species (Population/Species at Risk Status)	Season	IBA criteria	Comments
Northern Groais Island	Grey Islands	Black-legged Kittiwake (W. Atlantic)	BR	-	Represents about 1% of the estimated western Atlantic population.
-	-	Colonial Waterbirds/Seabirds	BR	-	More recent estimates of the size of this colony are not available.
-	-	Common Eider	WI	-	Aerial survey failed to locate any eiders at this site. Large numbers of eiders were recorded around the Fischot Islands (about 20 km to the north).
Bell Island South Coast	Grey Islands	**Common Eider** (Atlantic)	BR	C	Represents over 1% of the estimated population for the *dresseri* subspecies.
-	-	Common Eider	WI	-	During aerial surveys completed in the winter of 1995, no birds were recorded in this area, although large numbers were observed about 50 km to the north around the Fischot Islands.
-	-	Harlequin Duck (Eastern/SC)	SU	-	Non-substantiated observations of 20 or more Harlequin Ducks.
-	-	Waterfowl	WI	-	-
Wadham Islands and adjacent Marine Area	Fogo Shelf	**Atlantic Puffin**	BR	G	This represents about 4.3% of the estimated eastern North American population.
-	-	Black Guillemot	BR	-	-
-	-	**Colonial Waterbirds/Seabirds**	BR	G	-
-	-	**Common Eider**	WI	G	As much as 9% of the estimated northern *borealis* population.
-	-	**Leach's Storm-Petrel** (W. Atlantic)	BR	G	-
-	-	Razorbill	BR	-	-
-	-	**Waterfowl**	WI	G	-

IBA site name	Surrounding EBSA	Species (Population/Species at Risk Status)	Season	IBA criteria	Comments
Cape Freels Coastline and Cabot Island	Fogo Shelf	Atlantic Puffin	BR	-	-
-	-	Colonial Waterbirds/Seabirds	BR	-	-
-	-	**Common Eider**	WI	G	May represent as much as 9% of the estimated northern (ssp. *borealis*) population.
-	-	Common Murre (Atlantic)	BR	-	-
-	-	Razorbill	BR	-	-
-	-	**Waterfowl**	WI	G	-

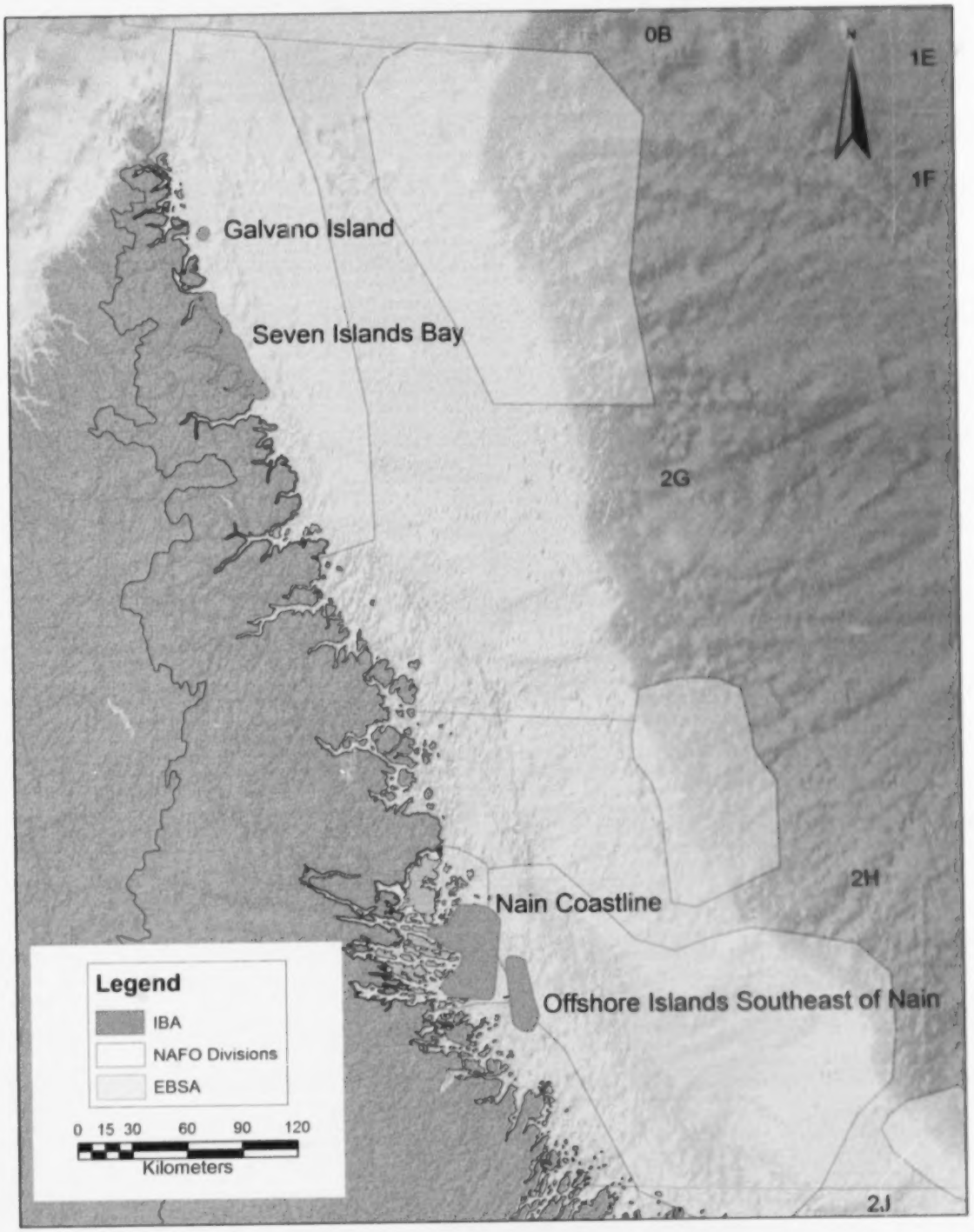

Figure F1a: Map of Important Bird Areas found within EBSAs in the NL Bioregion.

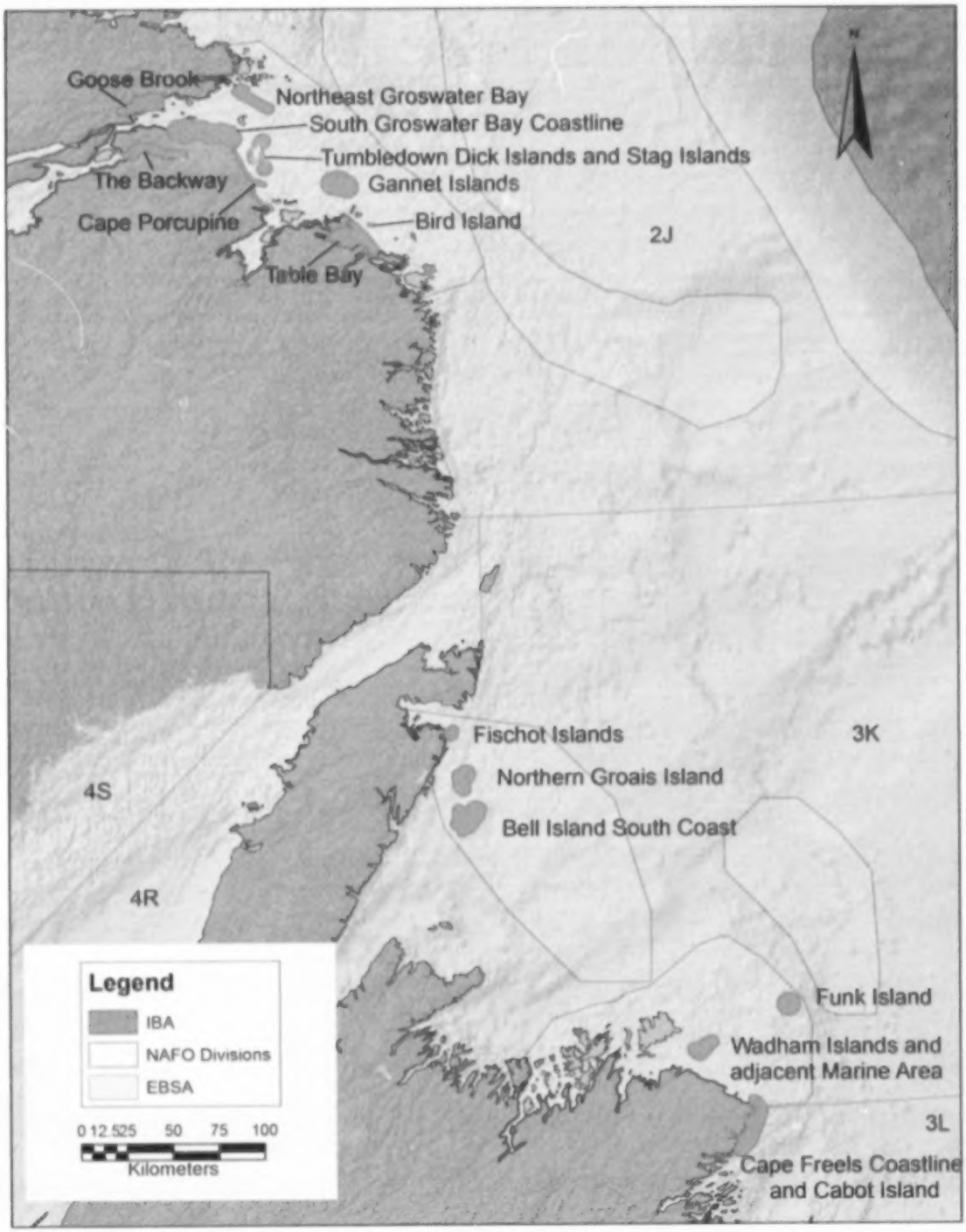

Figure F1b: Map of Important Bird Areas found within EBSAs in the NL Bioregion.